THE

AMERICAN NATURALIST.

VOL. XVII.—*NOVEMBER*, 1883.—No. 11.

THE PRE-CAMBRIAN ROCKS OF THE ALPS.[1]

BY T. STERRY HUNT, LL.D, F.R.S.

THE writer began by reviewing the history of Alpine geology, and noticed first that speculative period when the crystalline rocks of the Alps, including gneisses, hornblendic and micaceous schists, euphotides, serpentines, etc., were looked upon as altered sedimentary strata of Carboniferous or more recent times. He then traced the steps by which these views have been discarded, and more and more of the rocks shown to belong to Eozoic or pre-Cambrian ages. In this connection the labors of von Hauer, Gerlach, Heim, Favre, Renevier, Lory, Gastaldi and others were analyzed, and reference was made to the great progress since the writer, in 1872, published a review of Favre on the geology of the Alps.

The sections by Neri, Gerlach and Gastaldi in the Western, and those of von Hauer in the Eastern Alps were described, and it was shown that all these agree in establishing in the crystalline rocks four great divisions in ascending order: 1st. The older granitoid gneiss with crystalline limestones, graphite, etc., referred by Gastaldi to the Laurentian. 2d. The so-called *pietre verdi*, or greenstone group, consisting chiefly of dioritic, chloritic, steatitic and epidotic rocks, with euphotides and serpentines, including also talcose gneisses, limestones and dolomites, and regarded by Gastaldi as Huronian. 3d. The so-called recent gneisses of von Hauer and Gastaldi, interstratified with and passing into granulites and micaceous and hornblendic schists, also with serpentines and crystalline limestones. 4th. The series of argillites and soft glossy schists with quartzites and detrital sandstones, including

[1] Read at the Minneapolis meeting of Amer. Assoc. Adv. of Science, Aug., 1883.

also beds of serpentine with talc, gypsum, karstenite, dolomite and much crystalline limestone. This fourth series, well seen at the Mont Cenis tunnel, is still claimed by Lory and some others as altered trias, but the present writer's view, put forth in 1872, that it is, like the preceding groups, of eozoic age, was subsequently accepted by Favre, and by Gastaldi, and is now established by many observations. To this horizon belong the crystalline limestones of the Apuan Alps, including the marbles of Carrara.

The writer next recalls the fact that he, in 1870, insisted upon the existence of a younger series of gneisses in North America, alike in the Atlantic States, in Ontario, and to the north-west of Lake Superior. These, in his address before the American Association for the Advancement of Science in 1871, he farther described under the name of the White Mountain series, and subsequently in the same year, called them Montalban. These rocks were then declared to be younger than the Huronian, and to overlie it, though in the absence of this latter it was pointed out that in Ontario and in Newfoundland the Montalban reposes unconformably upon the Laurentian. When these newer gneisses and mica-schists were first described in 1870, there was included with them an overlying group of argillites, quartzites and crystalline limestones, and for the whole the name of Terranovan was suggested provisionally; but in defining in the following year the White Mountain series, this upper group was omitted, and was subsequently referred to the Taconian series, the Lower Taconic of Emmons, and the so-called altered Primal and Auroral of H. D. Rogers, in Eastern Pennsylvania.

The writer next described his own observations in the Alps and the Apennines in 1881. He affirms the correctness of Gastaldi in referring the groups one and two to Laurentian and Huronian, finds the third, or the younger gneiss and mica-schist group of the Alps, indistinguishable from the Montalban, and regards the fourth as the representative of the American Taconian. It was maintained by Gastaldi that these pre-Cambrian groups of the Alps underlie directly the newer rocks of Northern and Central Italy, forming the skeleton of the Apennines, reappearing in Calabria, and moreover protruding in various localities in Liguria, Tuscany and elsewhere. The serpentines, euphotides and other resisting rocks thus exposed have been regarded as

eruptive masses of Triassic and Eocene time. The writer, however, holds with Gastaldi that they are indigenous rocks of pre-Cambrian age exposed by geological accidents.

The uncrystalline rocks of the mainland of Italy are chiefly Cenozoic or Mesozoic, and the only Paleozoic strata known are Carboniferous, the organic forms of the limestones of Chaberton having been shown to be Triassic. Triassic, Liassic, Cretaceous, Eocene and Miocene strata are found in different localities resting on the various pre-Cambrian groups. In the Island of Sardinia, however, all these are overlaid by a great body of uncrystalline lower Palæozoic rocks in which the late studies of Bornemann and Meneghini have made known the existence of a lower Cambrian fauna, including Paradoxides, Conocephalites and Archeocyathus, succeeded by an abundant fauna of Upper Cambrian or Ordovian age. In the Island of Elba, according to Lotti, rocks containing the latter fauna repose directly upon the crystalline schists with serpentines.

The existence of the younger or Montalban gneiss in Sweden, and in the Harz and the Erzgebirge was noticed, and to it were referred the Hercynian gneisses and mica-schists of Gümbel. The presence both in Sweden and in Saxony of conglomerates, as described by Hummel, and by Sauer, wherein pebbles of the older gneiss are enclosed in beds of the younger series, was discussed, and the direct unconformable superposition of the latter upon the older gneiss, in the absence of the Huronian, was considered; evidences of the same relations being adduced from the Alps. The gneisses of the St. Gothard, as seen on the Italian slope, were also referred to the newer series, and the important studies of Stapff, in this connection, were discussed. It was declared that the views put forth by the author in 1870–71 on the relations and succession of the crystalline stratified rocks in North America, and then extended by him to Europe, have been fully confirmed by the labors of a great many European geologists, as already shown. Those of Hicks, Hughes, Bonney, Callaway, Lapworth and others in the pre-Cambrian rocks of the British islands were cited in support of these conclusions. It was said that whatever may have been the conditions under which these vast series of crystalline stratified rocks were deposited, there is evidence in the similarity of their mineralogical and geognostical relations of a remarkable uniformity over widely separated regions of the

earth's surface, as well as of long intervals of time, marked by great foldings and disturbance, and by vast and wide-spread erosion of the successive series of rocks.

In conclusion, the writer took occasion to call attention to the important labors of the present school of Italian geologists, and their great zeal, skill and disinterested service, as shown in the memoirs of the R. Academia dei Lincei, and in the work of the Royal Geological Commission, including the special studies, maps and memoirs prepared by it for the International Geological Congress of Bologna in 1881. The new Geological Society of Italy, founded at the same date, gives promise of a brilliant future, and has already published many important memoirs.

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THE ACHENIAL HAIRS OF TOWNSENDIA.

BY PROFESSOR G. MACLOSKIE.

THE genus Townsendia of Hooker, belonging to the Asteroid Compositæ, includes about seventeen species, inhabitants of the Rocky Mountain region from New Mexico and Colorado to Eastern California. They are remarkable for the prostrate, hoary habit of most of the species, the linear or spathulate leaves being crowded in rosettes around the rather large flower-heads; the hemispherical or broad campanulate involucre consisting of a few series of imbricating lanceolate bracts with scarious lacerate margins; the plane receptacle; the anthers obtuse at the base; the flattened branches and lanceolate appendages of the styles of the disk-flowers; and most of all for the pappus of the disk-flowers consisting of many (fifteen to thirty) stout bristles, thickened downwards, unequal and scabrid or barbellate. One species (*T. eximia*) has the pappus consisting of two chaff-like bristles arising from a ring of coalescing scales; and in several species the pappus of the ray-flowers is shorter than in the disk, or consists in whole or in part of scales. *T. wilcoxiana* has the pappus very long and fine upwards, but its bristles are thickened or rigid below; and in *T. spathulata* the pappus-bristles are somewhat slender, but their bases are thickened and coalescing into a ring, so that all fall off together. The achenes are flattened with the two angles thickened; sometimes those of the ray-flowers are triquetrous; they are narrow-obovate and more or less pubescent, save in *T. eximia*, where they are broad-ovate and glabrous.

In Professor Asa Gray's synopsis of the species of this difficult genus,[1] the species are arranged in two sections, according to the size of the flower-heads and the more or less decided acumination of the involucral bracts; and for sub-sections most use is made of the characters of the achenial hairs. In some of the species the hairs covering the fruit are described as acute or 1–2 dentate, or again as 2–3 cleft or bracted; and in a large sub-section (including ten out of the seventeen species) the distinguishing character is "achenial hairs *glochidiate-capitellate, i. e.*, briefly bidentate at the apex, the teeth obtuse, recurved and sub-glandular (?)," whilst an additional species of a preceding section is shown to have similar hairs. This peculiarity of the hairs is referred to in Torrey and Gray's Flora of North America as to *T. sericea* ("hairs minutely capitate"), but not as to any of the other species. In Vol. VI of Wheeler's Survey it seems to be indicated in the plate of *T. Rothrockii.*

In a former paper[2] I described and figured the curiously hooked hairs of the fruit of *T. grandiflora*, and explained them as a special case of the duplex hairs which I had found to be characteristic of the Asteroideæ and of most of the other tribes of the Compositæ. Professor Gray kindly suggested that I ought to extend my examination to all the species of Townsendia, and for this purpose he generously furnished me with materials from the Harvard collections. I have also to acknowledge additional specimens kindly furnished by Professor Vasey, of the Agricultural Department at Washington.

My first step was to test the glabrous achenes of *T. eximia*, as previous experience had shown that the glabrous species of genera belonging to what I may term the duplex tribes, themselves bear some duplex hairs, few in number or reduced in size, but sufficient to establish their affinity. It was consequently no surprise to observe in the first shred examined from the achenial wall of *T. eximia*, several stout duplex hairs (each .23^{mm} by 0.27^{mm}) with abruptly divaricating and slightly recurving tips, a decided case of the "glochidiate-capitellate" pattern. These hairs are so sparse as not to disturb the specific qualification of "glabrous achenes;" but they justify its reference to this genus, notwithstanding its chaffy pappus, and suggest that it (along with *T.*

[1] Proc. Amer. Acad. Arts and Sci., Vol. XVI, p. 82 (1880).

[2] On the Achenial Hairs of Compositæ, AMERICAN NATURALIST, Jan. 1883.

grandiflora) may be well shifted into closer proximity with the glochidiate sub-section.

The next step was to examine the species represented as having simple hairs. I was prepared for such, because in other genera I have sometimes found the simple (as also the multicellular) hairs of the perianth invading the achenial surface so as to become intermingled with the duplex hairs. But in Townsendia no such phenomenon has as yet presented itself to my view. Although quasi-simple hairs abound on the achenes of some of the species, they are all really duplex. For descriptive purposes the term "simple" may perhaps be retained; but they are only apparently such. The semi-hairs sometimes grow finer upwards, ending in a straight point; the companion semi-hair will then be shorter, with its point hiding in the wall of the longer one, or with the point slightly or even abruptly diverging; and in these cases a third division may be sometimes seen nearer the base, thus giving variously the aspect of hair simple, or two-, or even three-toothed; in such cases the semi-tubes of the composite hairs are unequal; a third tooth sometimes arises from an extra process on a semi-hair. In *T. florifer*, where the point of one semi-hair was frequently hid behind the other, by rolling it under the cover glass we could readily bring it into view. Occasional triplicity of these hairs accords with what occurs in other genera, and is caused by one of the basal cells growing up beside the semi-hair which it bears; we have observed it in some species of Townsendia not so described in the Synopsis (*T. Parryi*, *T. wilcoxiana*, &c.), and it may perhaps be expected as an occasional variation, at least, in all the non-glochidiate species.

The "glochidiate-capitellate" character is merely incidental to the general binary structure of the hair. When the semi-hairs are of equal dimensions throughout, and when they rise to the same level before they abruptly diverge, then the diverging extremities spread out and recurve like the two flukes of an anchor; and in one species (*T. wilcoxiana*) the whole duplex hair is very long and slender, and its long extremities are circinately recurved. The average dimensions of the hairs in the other species is .28^{mm} to .35^{mm} long, by .022^{mm} in breadth. Each of them is a double tube, like the two barrels of a fowling-piece. In a broken hair of *T. Rothrockii* I was able to chase air-bubbles up and down the tubules, those in adjoining tubes being independent of each other,

and to expel the bubbles at the fracture. On placing unbroken hairs in fluid, one may observe the fluid penetrating the wall and very quickly displacing the enclosed air.

The quasi-glandular appearance of the diverging and recurving extremities of these hairs in some of the species, may be a case of sphacelation, the delicate apex contracting as it withers, and its contents becoming discolored. It is not impossible, however, that the basal cell of the upper semi-hair (the one next the apex of the achene) is a glandular sac; as it appears to become gorged with fluid, and so to erect the hair which swings on the basal cell of the lower semi-tube as on a hinge.

Many of the hairs of *T. spathulata*, and sometimes those of other glochidiate species, have one of the semi-hairs ending sooner than its comrade, sometimes just at the place for diverging. In this way we get a uni-glochidiate condition (like an anchor with only one fluke).

The examination of *T. Watsoni* started a difficulty which I have not been able to solve. Gray describes its achenial hairs as "short, obtuse, or having 2–3 obtuse apical teeth;" I find them in the specimens under examination to be .3^{mm} to .34^{mm} long (with a few short ones intermingled), the semi-tubes not diverging, somewhat swollen at the extremity, occasionally one of the semi-tubes outgrowing its comrade and then slightly bending outwards. I do not find any of them lobed or toothed or triple (an extra tooth may grow on one of the semi-hairs). But it ought to be remembered that the entire condition may be in order of growth the forerunner of the divided condition; this I have seen to be the case in other genera. The same explanation may apply to *T. condensata*, whose achenial hairs in the specimen before me are obtuse, one of the semi-hairs slightly exceeding the other; perhaps they divide at a later stage.

With these reservations and explanations the following analysis is submitted as an attempt to bring together all the glochidiate-capitellate species, and to marshal the other species around them. *T. wilcoxiana* may get a sub-section for itself, being well characterized by its very long pappus (11^{mm}, the average of the other species being 6^{mm}), and its long and delicate duplex-hairs with their circinately rolled tips. *T. Watsoni* seems, by its achenial hairs, to come near *T. condensata*, but other characters prevent their approximation. *T. condensata* has a number of slender

capillary filaments intermingled with the stout pappus-bristles. Three species *T. Fendleri, T. mexicana* and *T. Watsoni* have very short achenes. For the other characters used in drawing out the following analysis, I am indebted almost exclusively to Gray's synopsis of the genus.

SPECIES OF TOWNSENDIA, HOOK.

A. Involucral-bracts decidedly acuminate; head large.

a. Low, wooly, perennial, with soft linear involucral-bracts. Pappus of about thirty bristles, with capillary filaments interposed. Achenial hairs obtuse, sometimes slightly and unequally toothed. 1. *T. condensata.*

b. Caulescent annuals or biennials with deciduous pubescence, and broad lanceolate involucral-bracts.

* Pappus of disk plurisetose; achenes narrow-obovate.

Erect; leaves spathulate, achene pubescent with acute or 1–2-toothed hairs. 2. *T. Parryi.*

Spreading; leaves narrow, ray-pappus of short scales; achenial hairs glochidiate. 3. *T. grandiflora.*

** Pappus of 2 subulate, chaff-like bristles rising from a crown of short scales; achenes broad-obovate, glabrous, but with a few stout glochidiate hairs. 4. *T. eximia.*

B. Involucral-bracts slightly or not acuminate; heads smaller or narrower.

c. Achenial hairs glochidiate, their tips usually recurving.

* Head about ¾ inch broad, sessile. Leaves broad-spathulate, glabrous. 5. *T. Rothrockii.*

** Heads about ⅔–½ inch broad, usually sessile. Plants silky or strigulose pubescent.

Depressed acaulescent; leaves linear or linear-spathulate, crowded around the head; involucral bracts mostly acute. 6. *T. sericea.*

Depressed sub-caulescent; leaves spathulate, short (½ inch long) around the hemispherical head; involucral-bracts mostly obtuse. 7. *T. arizonica.*

Depressed caulescent or sub-caulescent; leaves narrow-spathulate and linear, the upper ones supporting the head; involucral-bracts silky; somewhat obtuse; pappus of ray much shorter than of disk. 8. *T. incana.*

*** Heads about ⅓ inch broad, sessile; leaves spathulate, villous-wooly; pappus-bristles coalescing at base into a ring, and falling off together. 9. *T. spathulata.*

**** Heads ¼ inch broad, hemispherical, usually short-pedunculate; involucral-bracts broad-lanceolate, slightly acute.

† Leaves and involucre glabrous, the leaves thickish, spathulate, the upper ones slightly exceeding the peduncle. 10. *T. glabella.*

†† Fine hoary pubescence; ray-pappus a crown of short scales, 1–2 setæ being often added.

‡ Leaves linear; involucral-bracts 3-seriate, unequal, acute; achenes short ($2\frac{1}{2}^{mm}$). 11. *T. Fendleri.*

‡‡ Leaves spathulate below, upper ones linear.

Involucral-bracts 2-seriate, rather broad, somewhat acute, outer ones shorter. 12. *T. strigosa.*

Involucral-bracts 2-seriate, equal, obtuse; achene small ($2\frac{1}{4}^{mm}$).
13. *T. mexicana.*

d. Achenial hairs long, slender; their branches long and circinately rolled downwards; heads ¾ inch broad; pappus of very long bristles (11^{mm}), thickening at base; plant depressed, acaulescent, glabrous.
14. *T. wilcoxiana.*

e. Achenial hairs obtuse, entire when young, afterwards 2-lobed; plant branching from root; head short-pedunculate, mid-sized; achenes short ($2\frac{1}{2}^{mm}$); leaves narrow-spathulate.
15. *T. Watsoni.*

f. Achenial hairs simple or bifid, the lobes acute; heads mid-sized, peduncle mostly naked.

Leaves cauline, linear, or the lowest sub-subspathulate, acute or acuminate; involucral-bracts linear-lanceolate.
16. *T. florifer.*

Leaves radical, spathulate, their limb mostly broad and short; heads on short scapes; involucral bracts somewhat broad-lanceolate.
17. *T. scapigera.*

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THE HIBERNACULA OF HERBS.

BY AUG. F. FOERSTE.

IN the fall of the year, as the weather grows colder, the production of the normal leaves of trees is suddenly checked. They wither and fall off. Instead of them we find a close, compact cluster of scales, and within these a number of young leaves and sometimes flower-buds. These scales are designed to protect the young leaves and flowers from the cold during winter; they are therefore called the *hibernacula* or winter quarters of the tender parts. Towards spring the growth of the inclosed leaves and buds is very rapid, so as to burst open their coverings and allow a speedy development of the floral organs. Hence most trees possessing scaly buds flower early in the spring of the year.

It may not be as well known, however, that it is not at all uncommon for the earlier flowering, perennial herbs to possess hibernacula, or winter buds, containing the flowers of the following year; and that many of them owe the power of early developing their flowers to this fact. On the study of a great variety of herbs belonging to all classes of flowering plants, during the winter months, it became evident that such cases were by no means rare. Such a study may reveal also many other interesting facts as the following pages will show.

Perennial herbs, on the approach of winter, die down to the surface of the ground. The stem still remaining beneath the earth is called the subterranean stem, and furnishes the buds from

which the next year's growth is developed. These buds may be either terminal or axillary. If they be axillary the terminal bud will not grow up into a flowering stalk, but will continue its growth beneath the surface of the earth; only the axillary buds along the stem will form the flowering branches from year to year. The result will be that the entire subterranean stem, which remains after the decay of the aerial stems on approach of winter, will have been the product of the single evolving terminal bud. Such a stem is called a monopodium.

Claytonia virginica L., has a hibernaculum composed of the dilated bases of petioles, which in early spring give rise to linear-lanceolate blades. Enclosed by the bases of the petioles during winter are the diminutive racemes which in spring elongate, show two opposite leaves toward their base, and stand in the axils of the now fully developed single leaves. The flowering branches are axillary and the growth is monopodial. In early spring several specimens were found in the frozen earth which had already begun growth.

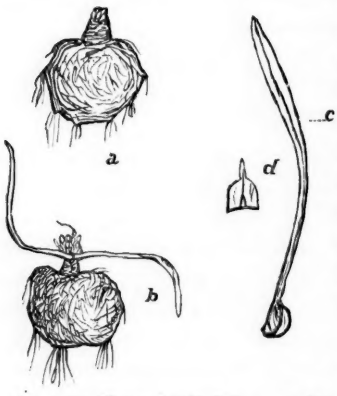

FIG. 1.—*Claytonia virginica*. *a*, plant in autumn; *b*, plant in February; *c*, leaf with broadened base; *d*, inflated base of undeveloped leaf.

On what do these plants live during the time they are encased in the frozen ground and still persist in growing? Evidently on the nutriment collected the year before within the tissues of the corm-like root. The rootlets are extremely few and small, and are generally arranged in dots on one great vertical circle about the so-called corm. When the nourishment has been withdrawn for the maturing of the plant, these little roots begin to lay up the store of food for next year's growth, and apparently it takes them all the year to do this. By autumn another bud is formed, which depends for its food not on the little rootlets, but on the store of food which they have accumulated.

Many other plants which have access to similar reservoirs of food, grow during seasons when the earth certainly cannot supply nourishment. *Thalictrum anemonoides* Michx., *Isopyrum biterna-*

tum Torr. & Gr., *Cardamine rhomboidea* DC., and *Erigenia bulbosa* Nutt., may be readily discerned beneath the fallen autumn leaves during the last days of January; and all of these have resource to food secured the previous year.

Trillium sessile S., is also a monopodium. The hibernaculum in this case is very highly developed, and encloses not only the perfect plantlet of the following year, with leaves, sepals, stamens and ovary, but also a little convex bud, from which the aerial stem two years hence is to develop. In the first week of February a plant hewn from the frozen ground, three inches beneath its surface, showed the leaves already protruding from the hibernaculum. Slowly this growth continues, perhaps only on warm days, until its proper season, April, arrives. The entire plant is then only an enlargement of the miniature already extant in autumn.

Uvularia grandiflora Smith, another of the Liliaceæ, has linear, oblong winter buds, which contain the aerial stems with their branches, the leaves and the terminal flowers all in a state of high development. They certainly contain a greater mass of detail than any other known hibernacula of herbs.

The winter-bud of *Asarum canadense* L., is very simple in structure, containing two leaves and a flower, enveloped by the loose scales, or specialized leaf-blades.

Anemone hepatica L., has a monopodial stem which produces no aerial branches; on this account the plant is said to be stemless. The bud consists of three small scales and three to four larger ones, the latter subtending each one flower bud. Within are seen three to four poorly developed leaves, which are very hairy.

Symplocarpus fœtidus Salisb., resembles the Anemone in having no aerial branches. A number of scales, showing by their variations that they are specialized petioles, are followed by a large number of leaves. The inner scales alone bear flowering spathes capable of development. However, almost all the earlier leaves contain in their axils abortive spathes, pointing to a probable summer flowering ancestor which could utilize them all. Both the Anemone and Symplocarpus have their flower buds highly developed, and being placed in the lower axils separate from the leaves, they receive the first nourishment and hence appear before the leaves. It is not unusual to find flowers in the first half of February which have mistaken the warmth of a few days for spring.

Arisæma triphyllum Torr., was observed by Mr. W. B. Werthner, who has taken great interest in the study of hibernacula. I

FIG. 2.—*Arisæma triphyllum;* top of bud two inches below surface of ground in February.

quote his observation in the lines following:

"The corm has several lateral buds, and is covered with a brown shredded husk, probably the base of last year's petioles. Within this coat are several thin membranous sheaths covering the whole bud, without seam or opening. The next two 'scales' are fleshy, each united so as to form a complete coat. The next sheath, fleshy too, is partly open at the apex, and overlapping, while the following one, continuous at the base, is convolute for about two-thirds of the upper part. There is then a sudden transition from bud covering to leaves and flowers. The flower bud is of almost the same size as the leaves. The spadix at this stage already plainly shows the ovaries, but of stamens no trace is found. At the base of the flower stalk is seen the bud for the *second* year's growth."[1]

FIG. 3.—*Arisæma triphyllum;* flower bud with convolute spathe, and bud for next year's growth.

Sanguinea canadensis L., is another plant which contains the flower bud in the hibernaculum

[1] The scales composing the hibernaculum of the Indian turnip may be considered as the modified sheathing petioles of leaves. The winter buds of the Arisæma and of a species of Trillium were discovered by Mr. A. P. Morgan, of Cincinnati, who communicated the fact to me.—*A. F. F.*

formed in the autumn. The specimens examined in the beginning of February had already commenced growing in spite of the frozen condition of the soil. The only way of insuring the condition of a hibernaculum before growth is to collect the herb in October or November.

The winter buds of *Dicentra cucullaria* DC., are surrounded by the enlarged bases of last year's petioles and by numerous small granules disposed on branches which often terminate in a leaf-bud. This would indicate that the granules are also bases of petioles which were arrested in their development early in life and specialized for the purpose of retaining the food which shall permit the plant to grow while the soil is still frozen. The hibernaculum contains the entire plant in a high state of development, forming a pretty sight even at this stage of growth.

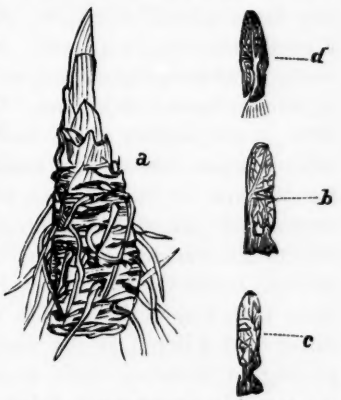

FIG. 4.—*Sanguinaria canadensis; a,* hibernaculum; *b, c, d,* leaves enwrapping flower bud after removal of the scales.

FIG. 5.—*Dicentra cucullaria; a,* tuberiferous bulb with hibernaculum (scaly bud); *b, c, d,* two leaves and raceme of flower buds after removal of the scales.

Earlier in this paper the formation of monopodial stems was described. In conclusion it may be well to note the formation of its opposite, the sympodial stem, or sympodium.

In certain plants, after the stem is of sufficient age to produce flowers, this office is undertaken by the terminal bud, which develops into an aerial stem for this purpose. When autumn arrives this decays, and it is evident that the continuance of growth must depend upon the development of the axillary buds. Next season these buds flower and their terminal parts are also

killed down to the surface of the ground. Here again growth becomes restricted to the axillary buds on these axillary branches. This continues from year to year, so that one branch is continually being placed upon the other, and each branch becomes limited to one year's growth. And when the result is an apparently continuous stem it is called a sympodium. *Polygonatum giganteum* has a sympodium. The stem of *Jeffersonia diphylla* Pers., is the product of the same sympodial development. The hibernaculum consists of a number of scales followed by a number of leaves, in the center of which, terminating the stem, is the flower-bud. This alabastrum is so highly developed as to have the complete advantage of the leaves, insuring its appearance and anthesis before the leaves have received sufficient nourishment to force their way to the air. In this way a similar result is produced to that noted in Anemone and Symplocarpus, where the placing of buds in axils beneath the leaf-bearing internodes, causes a like appearance of flowers before leaves.

Summary.—The list of plants has now been sufficiently extended to note the principal characters of hibernacula among perennial herbs.

The winter-buds of herbs consist of scales which owe their origin to different parts of leaves (blades, petioles)[1] as in trees. They never attain the indurated character nor the resinous properties of scales in arboreal vegetation, but like them are sufficiently protective to enclose the leaves and flowers of the following year and preserve them from the effects of a sudden change of weather. Unlike the hibernacula of trees, the inclosed parts begin to grow early in winter, and often break the bounds of their enclosures to develop and push their way up through the frozen soil. They are enabled to do this by the supplies of nourishment furnished by subterranean reservoirs in the shape of thickened stems or roots. The existence of such winter-buds, containing the flower-buds of the next season, is by no means rare.

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THE HAIR-SAC MITE OF THE PIG.

ABSTRACT BY PROF. R. RAMSAY WRIGHT.

IN view of the discovery of the hair-sac mite (*Demodex folliculorum*) in the pig in America, a synopsis of Dr. Csokor's paper may be of interest.

[1] The scales which envelop the sympodially arranged bud of *Geranium maculatum* are evidently dilated stipules.

After discussing the occurrence of hair-sac mites in man, the dog, the cat, the Surinam bat, and in the Meibomian glands of sheep,[1] he considers the question of the specific identity of the parasites in question, and especially the possibility of transference from one species of animal to another. He gives a synopsis of the various experiments which have been made to determine this point. Gruby succeeded in infecting a dog with the Demodex of man, and Zürn relates a case in which a veterinary surgeon, a coachman and his wife, who had the care of a dog suffering from

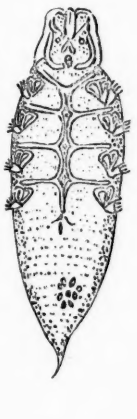

Fig. 1.

Fig. 2.

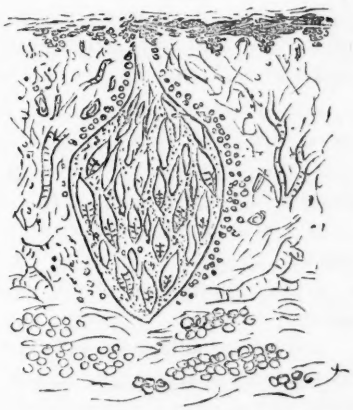

Fig. 3.

FIG. 1.—*D. phylloides* : male ventral aspect—the small fissure near the front of the ventral surface of the abdomen is the anus, in front of this two folds represent the penis. FIG. 2.—Female, ventral aspect—the abdomen contains an egg undergoing segmentation ; genital and anal fissure behind the sternum. FIG. 3.— Section of skin of pig, with sebaceous gland filled with mites; incipient inflammation.

Demodex-mange, had their hands and feet soon covered with pustules in which hair-sac mites were present.

On the other hand Rivolta endeavored, without success, to infect one dog from another, and Mortemucci failed to transfer the mites from one part of an affected dog's skin to another.

Again, doubtful results are recorded by Friedberger and Weiss. It is not infrequent to see dogs perfectly free from the skin disease living in the same kennel with affected animals, a circumstance which points to the conclusion that the conditions which favor contagion are often absent.

[1] He overlooks the observations of Gros and Haxon.

In no animals except the dog and the pig does the Demodex seem to cause any troublesome skin disease; in the dog, however, this is very generally fatal.

From purely zoölogical methods of observation, both Leydig and Megnin have come to the conclusion that the forms of Demodex described by them are at least different varieties, and the fact that the Demodex of man occurs in the least hairy parts of the body and is perfectly harmless, whereas that of the dog is found in the most hairy places, and may cause a fatal disease, seems to point to the non-identity of the two forms.

Dr. Csokor next treats of the natural history of the Demodex of the sow, and by a series of measurements defends its specific distinctness. He sums up his table of dimensions as follows:

1. *D. phylloides* only reaches the minimum length of *D. canis*, never that of *D. folliculorum*.

2. The length of the abdomen in relation to that of the whole body is in *D. phylloides* ½, *D. canis* ⅓, *D. folliculorum* ¼.

3. The relation of the breadth to the length is comparatively twice as great as in the other forms.

4. The appendages of the mouth are more robust and thus easier to study.

5. The egg is larger and is rather oval than fusiform; the six-footed larva is also larger than in the other two forms, while the eight-footed larva is larger than that of *D. canis*, but smaller than that of *D. folliculorum*.

6. The differences between *D. phylloides* on the one hand, and *D. canis* and *D. folliculorum* on the other, are of much greater extent than the difference between the two latter varieties.

After describing the regions of the body, he calls attention to the cuticle and the chitinous pieces which strengthen it. The transverse furrows on the abdomen (which is produced into a sharp point posteriorly) are shallower towards the thorax; he considers these as traces of segmentation. On the middle ventral line of the thorax is a chitinous ridge which gives origin to four pairs of transverse bars, to the outer thirds of which the appendages are movably articulated; the first pair of transverse bars separates the thorax from the head completely. The appendages are three-jointed, the basal joint being three-sided; they are terminated by five claws, of which two appear to belong to the second joint and three to the distal.

The following are the appendages attached to the cephalic segment:

1st. A pair of mandibles seen best from the dorsal surface and resembling a pair of scissors of which both the blades are terminated by blunt points.

2d. A pair of maxillæ which lie in a depression on the under surface of the cephalic segment.

3d. A pair of pedipalpi which are three-jointed, the middle joint being soft while the last bears three incurved hooks.

4th. An unpaired stylet seen only from the ventral surface between the maxillæ, which appears to be connected with the pharynx.

The appendages of the mouth move chiefly horizontally, and are therefore of a masticatory nature, but the closed maxillæ form a sharp point anteriorly and thus form a piercing organ.

Some interesting particulars are given as to the development of the cephalic segment and its appendages. The clear anterior end of the egg is rounded off as the head segment, and already the pedipalpi and the future eyes may be seen; the depression between the pedipalpi is then occupied by the outgrowth of a pyramid which by a cleft in the middle line and a further longitudinal division of each of the resulting halves is converted into the mandibles externally and the maxillæ internally.

The pharynx is lined with chitin, and a short œsophagus leads from it to the stomach, which occupies the greater part of the thorax and which is seen in optical section to possess a wavy contour. Csokor considers this to be due to gastric cœca such as are generally present in the Arachnida. The short intestine opens on the ventral surface behind the sternum in a fissure, which is twice as long in the female as it is in the male.

A group of refractive particles in the end of the abdomen are interpreted as urinary concretions; they are to be traced also in the earlier stages of development.

In stained specimens a rudimentary tracheal system is to be detected from the dorsal surface, composed of two longitudinal canals running back as far as the last pair of legs. These canals have a few branches and may possibly open on the exterior by certain little protuberances which have already been described by Leydig and Megnin.

Two little crescentic bodies, further back upon the dorsal surface, are interpreted as rudimentary circulatory organs.

Csokor has studied the locomotion of the mites in a drop of oil on a hot stage, and finds the movements which are, at the ordinary temperature, so sluggish, become then so energetic that he considers the want of success of various experiments as to infection to be due to the absence of a sufficiently high temperature. He calls attention to the fact that the disease has been rapidly spread over the surface in a dog by the use of warm water in washing affected spots, and that probably also the raising of the temperature of the skin by the rubbing in of ointments may contribute to the spreading of the parasite. He found that the pedipalpi are particularly active in locomotion, and are able to bore into a soft surface.

Only the two terminal joints of the legs take part in locomotion; the head may be moved from right to left and also upward and downward—the combination of these movements resulting in a rotation of the head upon the thorax. The abdomen may be also flexed against the thorax in very active locomotion.

The eyes, which appear very early in development, are destitute of pigment in the adult, and are situated upon the dorsal surface near the mandibles.

The male is shorter than the female; the appendages of the mouth are less developed; the abdomen is less than half the length of the body; between the anal opening and the end of the sternum are two curved chitinous pieces which represent a penis.

The female is at once distinguished by the longer abdomen and the three-sided structure which it contains, and which is eventually discharged through the fissure behind the sternum as the egg; the oviposition has been observed by Megnin.

Csokor has traced the occurrence of three molts, the first between the egg and the six-footed larva, the second between the six-footed and the eight-footed larva, the third between the eight-footed larva and the adult.

Csokor concludes his observations by describing the mode of occurrence of *D. phylloides* in the pig; it is found in the sebaceous glands right and left of the snout, and on the neck, flanks and ventral surface and especially on the internal surface of the extremities, while the back and sides are free from the attack. The hair-follicles in these localities are only accessory to the sebaceous gland. Fig. 3 represents a section through an affected

gland. The cast-off cuticles are found toward the center of the knots formed by the mites while the adult individuals occupy the periphery, their heads being directed towards the bottom of the gland. He considers that the habits of the pig would render contagion easier than in other animals, and thinks that had the swine he examined not been killed, the result of the disease would probably have had as fatal an issue as is generally observed in the similar disease in dogs.

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THE GEOLOGY OF CENTRAL AUSTRALIA.

BY EDWARD B. SANGER.

THE geology of the great central basin of Australia has until recently been a matter of some uncertainty. From analogical reasons conclusions have been formed which are more or less correct. Still at best they were but shrewd guesses. Our knowledge has been of a limited kind. The various explorers who have ventured to cross the continent have seldom taken any scientific men with them. Hence the reports received from time to time of this *terra incognita* have been vague and conflicting. Australia nevertheless has had not a few advantages in its scientific history. Many men of science whose reputation is now world wide, first became known to fame by their work on Australian shores. But the attention of naturalists has been restricted, for the most part, to the east coast of the continent, while the remainder has been comparatively neglected. This, to a certain extent, was unfortunate, as the east coast possesses the novel Australian features in the least degree. It shares its peculiarities with other approximately well-known regions. Thus on the north-east coast there is a large intermixture of Asiatic characters. These are less marked as the coast is followed to the southward, but still there is a large proportion of forms belonging to the Pacific islands, New Zealand, &c. On the south coast, however, the case is different. Here the flora and fauna are peculiarly Australian. The physical differences between Sydney harbor and Melbourne are slight, but according to Tenison-Woods, the marine fishes are of different species. The geological structure of the south and east coasts also differs widely.

Taken in its totality Australia is built on the true continental model. It has the characteristic elevated borders and the de-

pressed interior. The highest border is on the east, facing the largest ocean, and it averages about 2000 feet in height. The south side is either level with the ocean or abuts upon it in cliffs varying from 300 to 600 feet in height. The western is about 1000 feet above the sea, and the northern a little higher. Australia is thus in the form of an immense table-land. The seaward side is generally precipitous, but narrow tracts of lowland sometimes intervene between the elevated region and the sea. The continent slopes gradually inland from the elevated borders to the central depression at Lake Eyre, which is south-east of the topographical center. The main cordillera of the continent forms the eastern border. It consists essentially of a central granitic axis with doleritic or dioritic dykes flanked by highly inclined Archæan and Silurian schists, Devonian rocks less inclined and altered, and the upper and lower coal measures. Over these lie the almost horizontal beds of the Hawkesbury series (Lower Mesozoic). It is generally conceded that this cordillera is of Palæozoic age, and was elevated at the close of that period. The western border, as far as is known, resembles the eastern.

Throughout the table-land are various isolated mountain ranges which do not extend for any distance. These ranges trend either nearly north and south or east and west. The largest of them is the Flinders, which begins at Cape Jervis on the south coast and extends to the south end of the Lake Eyre basin where it ends abruptly. West of Lake Eyre is a chain trending about north-north-east, consisting of two ranges, the Peake and Mt. Margaret. North-west of these, on the 26th parallel, is a large range, the Musgrave, which trends about east-north-east. North of this is another, the MacDonald, parallel to it. These are the main ranges, but isolated mountains of granitic base crop out in various places.

The south side of the continent is formed, with but little interruption, by a series of Tertiary rocks, representing probably all the formations from the Eocene upwards. They extend inland for at least 400 or 500 miles. The cliffs that abut on the sea in the Australian Bight are Miocene. The Murray River basin is also formed by Tertiary rocks of various formations. On the eastern and south-eastern coasts these deposits are overlaid either by volcanic emanations or by sands, clays and marls derived from the sub-aërial weathering of the Palæozoic rocks. The volcanic

deposits are Tertiary, and sweep around the eastern side from north to south, becoming more recent to the southward. Mt. Gambier and Mt. Schenck are volcanic cones which are situated near the southern limit of this disturbance. On the south side of the continent raised beaches are common, but are of limited extent. The great central depression, is, like the Saharan desert, of Mesozoic age. Its limits are as yet not strictly defined. Mesozoic fossils have been found on the east side all around the Gulf of Carpentaria, and I have found Jurassic fossils *in situ* 300 miles west of the overland telegraph line. Covering the Mesozoic beds in the interior are eolian deposits and drifts. On the north coast the Palæozoic rocks outcrop again and are overlaid unconformably by Mesozoic rocks. Such is the general structure of the continent.

The region which I intend to discuss especially is that lying between the south parallels 22° and 30°, and the meridians 130° and 140°.

The country contained within these limits comprises very nearly the known limits of the great central basin. How much farther it extends to the westward is a matter of doubt. If a vertical east and west section could be cut through this basin from the eastern cordillera across Lake Eyre and through the Peake range, the approximate position of the rocks would be as seen in the diagram:

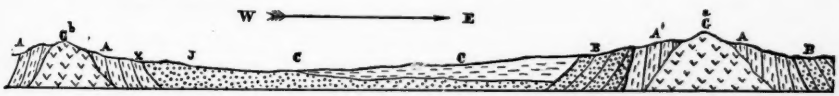


FIG. 1.—*G–G*, granite; *A–A*, Archæan schists; *A'–A'*, Archæan and Silurian schists; *B–B*, Devonian and Carboniferous; *C*, Cretaceous; *J*, Jurassic; *a*, eastern cordillera; *b*, Peake range; *c'*, Lake Eyre basin. *x*, outcrop of springs.

Now if a section were cut in a like manner through the Peake range on the east, in a north-westerly direction through the Musgrave range, we should have a section as seen in Fig. 2:

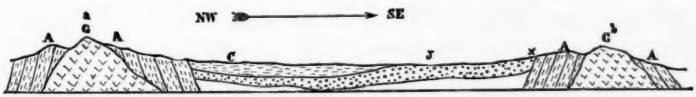


FIG. 2.—*G–G*, granite; *A–A*, Archæan, *J*, Jurassic; *C*, Cretaceous; *a*, Musgrave range; *b*, Peake range; *x*, outcrop of springs.

The Musgrave ranges at their base are about 3000 feet above the level of the sea; the Peake range 800 feet; Lake Eyre 300

feet; and the eastern cordillera 3500 or 4000 feet. Thus there is a gradual slope from the east and the west towards Lake Eyre. The Peake range, arising as it does, roughly divides the great basin into an eastern and western portion. It is worthy of remark that the Peake range is flanked by the Jurassic formation on each side, while the Cretaceous beds flank the ranges on the extreme eastern and western boundaries. There is evidence to show, however, that the latter beds are underlaid by Jurassic rocks. The Musgrave range consists of a central core of granite, flanked on either side by a great variety of gneissoid rocks much folded and inclined at a high angle. Many dykes of doleritic rocks cut through the metamorphic gneisses.

The granite varies greatly in character within short distances. The most common is a large porphyritic variety with a coarsely granular base. The orthoclase crystals often measure three inches in length. Mineralogically the granite is usually of the normal ternary kind, *i. e.*, consists of orthoclase, quartz and mica. The mica is almost invariably biotite. Sometimes oligoclase is found with the orthoclase, and often completely replaces it. In other localities the granite loses its quartz and mica, and those minerals are replaced by hornblende, the rock becoming a pure syenite. Then again in the syenitic form the orthoclase takes a subordinate place and is replaced by oligoclase. In this variety I have found small quantities of augite as an accessory mineral. These varieties of composition all occur in the same mass and may be stated as follows:

a. Normal.—Consists of orthoclase, quartz and biotite. Tourmaline often present in small pockets or nests.

b. Hornblendic.—Same as above but contains hornblende.

c. Oligoclase-bearing.—Oligoclase present and sometimes completely replacing the orthoclase.

d. Syenitic.—Hornblende replacing the biotite. Quartz quite or nearly absent.

e. do. Oligoclase-bearing.—Consists of hornblende and oligoclase. Is a dark gray. Resembles the rock called trachydolerite (Abich). Augite sparingly present as an accessory mineral.

The granite may thus be said to vary from its normal composition to a syenite. The normal rock is by far the most abundant. Next in order is the syenitic variety.

The gneissoid rocks flanking the granite vary as much in composition and physical characters as the granite itself. The most common kind is a light gray coarse granular gneiss consisting of quartz, orthoclase and muscovite or biotite, sometimes both of

the micas. This normal rock passes on one hand into metamorphic granulite which has two varieties, one a fine-grained white rock containing a preponderance of quartz; the other reddish and coarse grained, in which the orthoclase predominates. This again passes into a true metamorphic muscovite-granite. This is a light white-gray rock moderately fine in structure, and is very different in appearance to the granite forming the central axis. On the other hand the normal gneiss may become (*a*) *hornblendic*, in which case it generally loses some quartz; (*b*) *garnetiferous*, containing crystals of almandite; (*c*) *epidotic*, containing epidote (pistacite). The last variety passes into unakite, a very beautiful rock consisting of dazzling white quartz, reddish orthoclase and yellowish-green epidote; and this again into pure epidosite by losing its feldspar. All these rocks alternate with each other, are much folded, incline generally at a steep angle, and strike north-east. I consider them to be of Archæan age; or the slates and schists which form the Flinders range, and are probably Cambrian or Lower Silurian, strike north-west and are unconformable to the Peake and Mt. Margaret ranges, formations which belong undoubtedly to the same horizon as the Musgrave Range rocks.

The central granite is more recent than the Archæan gneisses, as it faults them and in places has partially re-metamorphosed them.

The dolerite rocks are probably more recent than the granite, and are as follows:

a. Dolerite.—Consists of augite, labradorite, magnetite, olivine and sometimes chlorite. Biotite is often present as an accessory mineral. In structure it varies from a granular crystalline to a jet-black aphanitic variety.

b. Norite.—A coarse dark reddish-gray rock, consisting of foliated pyroxene and labradorite.

c. Augite-Andesite.—A nearly black, fine, granular rock consisting of andesite and augite. The latter is often in distinct though small crystals, giving the rock a porphyritic structure.

The main dykes follow the strike of the metamorphic rocks, but innumerable cross dykes are given off which run in every direction. What the exact chronological place is for the granite and these rocks it is as yet, in the present state of Australian geology, impossible to say. About sixty miles south of the Musgrave range there is another range exactly similar in every particular, which is known as the Everard. The MacDonald

range to the north is also constructed on the same plan. In the Everard range the doleritic rocks are better developed, but occupy the same position and show the same variation in composition and structure. The two ranges are in fact counterparts of each other.

The Peake and Mt. Margaret chain has essentially the same structure, with the exception that the doleritic rocks are apparently wanting. The Archæan gneisses exist here in the form of crystalline schists, quartzites and limestones, and vary in character. The strike is north-east, and they dip to the north-west at a high angle. The schists are as follows:

Mica schist.—Contains both muscovite and biotite.
- *a.* Tourmalinic.
- *b.* Specular (Itabyrite) containing much hematite.
- *c.* Calcareous.

Hydromica schist.—Containing margarodite in place of the muscovite.
- *a.* Garnetiferous.
- *b.* Pyritiferous.
- *c.* Chloritic.

Chlorite schist.—Greenish-gray.
- *a.* Garnetiferous.
- *b.* Epidotic.

Hornblende schist.—Consists of quartz and hornblende. Sometimes wholly of hornblende.

Actinolyte.—A tough, light-green rock.

Intercalated between these beds of schist are strata of:

Quartzite.
- *a.* Feldspathic (orthoclase).
- *b.* Micaceous (muscovite).
- *c.* Tourmalinic.
- *d.* Hornblendic.

Hematite.—A dark red rock. Jaspery.
- *a.* Foliated hematite (micaceous iron ore).

Limestone.—Coarse grained, blue, clinking under the hammer.
- *a.* Pyritiferous.
- *b.* Graphitic.
- *c.* Micaceous.

Through these metamorphic rocks irregular masses of granite have been intruded, though not to so great an extent as in the Musgrave range. The granite is more hornblendic, but quartz is always present. It is much coarser in grain, and is porphyritic. Veins of orthoclase of considerable size are present in it.

Through the metamorphic rocks are also: (1) Quartz veins bearing much pyrite. Near the surface this has been oxidized,

and the quartz is cavernous. These veins follow the strike of the schists.

(2.) Faulting them are veins of calcite in which are found the following minerals: *Pyrite, chalcopyrite, malachite, bornite, galenite* and *selenite*. None of these minerals are present in any quantity. The calcite veins are seldom over six or eight inches in width, while on the other hand the quartz veins attain, in some places, a diameter of many feet. One in particular, situated near the foot of the range at the Peake telegraph station, stands up like a gigantic white buttress about fifty feet high, and is nearly eighty feet in width. Many similar examples could be given.

The next formation in age is that forming the Flinders range, which we have mentioned as ending abruptly south of Lake Eyre. It is probably Cambrian or Lower Silurian, but is so singularly destitute of fossils throughout its entire length, that no exact data, except from a lithological standpoint, are known. The rocks are schists, slates, limestones and quartzites. They are very different lithologically from the Archæan rocks; they strike north-west and are much folded and inclined at high angles. Metalliferous veins are abundant in them. The great copper deposits of South Australia are in rocks of this age. The ores are sulphides. Carbonates of copper are abundant, but have not as yet proved to be permanent. Gold is very generally found in the quartz veins which run north-west, following the strike of the rocks. The cross veins are not so rich. In the southern parts of the range there are large deposits of galenite, which is very generally argentiferous. Besides these minerals, deposits of bismuth, graphite, antimony and manganese are found, but are not worked. The Cambrian rocks in fact all over the continent are the richest in metalliferous lodes; although quantities of tin are found in the granite of the Queensland cordillera.

The Jurassic formation abuts unconformably against these Cambrian rocks at their northern termination. It is of vast extent, covering the whole of the central part of the great basin. Lithologically, curiously enough, it bears a striking resemblance to other deposits of the same age in various parts of the world, but notably in England and in the Western United States.

The beds are uniform in character and consist of compact gray shell-limestones, gypsiferous marlites, and sandstones. The limestone is fossiliferous and contains the following characteristic

forms: Monotis, *M. curta; Mytilus minimus, M. ingens*, n. s. (Tenison-Woods); Tancredia; Cytherea; *Lima gigantea; Cardinia listeri;* Pleurotomaria; *Cucullæa oblonga;* Avicula; Pecten; and Modiola. In the gypsiferous marlites are found many calcified Belemnites, *B. canaliculatus* and *B. densus*, but no other fossils, as far as I was able to ascertain.

The beds are generally horizontal, but in some places are slightly inclined. The inclined strata give rise to the low table-top hills mentioned above. About a hundred miles west of the Peake range there is a range of rough flat-topped hills trending north. These consist of eruptive felsite breaking through the Jurassic strata, partially metamorphosing and folding them, but only in the immediate vicinity of the eruption. The felsite is fine granular in texture, and varies in color from white to red.

A section taken near the outbreak of felsite shows the rocks in the following order, beginning at the surface: *a.* Sandstone conglomerate, cross laminated in many places; *b.* Gypsiferous marlite, containing Belemnites; *c.* Compact gray fossiliferous limestone; *d.* Compact ferruginous sandstone. This order of superposition is the same wherever I have seen the Jurassic beds in the interior. A cross section of the Peake range is as seen in Fig. 3.

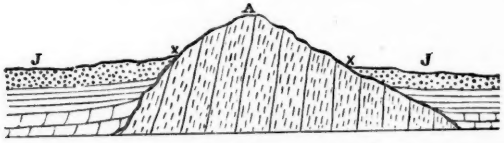


FIG. 3.—*A*, Archæan schists; *J*, Jurassic beds; *x*, springs.

The sequence of the Jurassic beds is the same as given above. At the Finiss springs these beds lie uncomformably against the Palæozoic rocks as seen in Fig. 4.

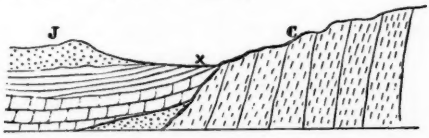


FIG. 4.—*C*, Cambrian; *J*, Jurassic; *x*, springs.

The beds do not vary lithologically, but the fossils are often absent. They seem to be distributed in patches. The compact sandstone in every natural section that I have seen is the lowest bed. Well borings, however, have shown that similar rocks un-

derlie them. What the thickness of the whole formation is, therefore, it is impossible to say. The thickness of the beds mentioned above is about 250 feet; in many places, however, some of the beds thin out and are wanting; this is notably the case with the fossiliferous limestone.

Lake Eyre lies south of the center of this great zone of rocks. They extend westwards probably nearly 300 miles. Then they sweep around the northern end of the lake and extend eastwards for about a hundred miles, as far as I have been able to ascertain. Circling around the northern boundary of the Jurassic beds and lying unconformably on them, where they overlap, is another series of rocks which varies greatly in character. In the northwest they consist principally of kaolin beds, sandstones and limestones. The kaolin beds are the best developed, and are undoubtedly derived from the masses of eruptive felsites mentioned above. These beds flank the Musgrave and Everard ranges and extend north an unknown distance.

The kaolin varies from a pure white, unctuous clay to gritty and indurated siliceous varieties of different colors. The finer kinds are very abundant. One in particular, known colloquially as the " Charlotte Waters' meerschaum," is a beautiful soft white variety. The Charlotte Waters telegraph station is built of it. Neither the kaolin nor the beds associated with them (sandstones and limestones) are fossiliferous, but eastwards they are continuous with beds resembling the Jurassic lithologically, but containing true Cretaceous fossils. So it is presumable that they belong to that age. To the north-east and east the Cretaceous beds extend to the Gulf of Carpentaria and some distance into Queensland. They consist here principally of sandstones and gypsiferous marlites containing Ammonites, Belemnites, Trigonia and remains of Ichthyosaurus.

South-east of this great Mesozoic basin lies the immense basin of the Murray river. The latter is covered with Tertiary deposits and is separated from the former by outcrops of the Cambrian rocks. The Mt. Poole and Mt. Browne range, about sixty miles south of Burke's grove at Innaminka, consists of these rocks and auriferous quartz veins are being worked there at present. Over the Cretaceous and Jurassic beds lie recent drifts and æolian deposits. The greater part of the continent, in fact, is covered with such formations, and as they are so extensive and important, I will write of them in detail.

They are of two kinds, sand drifts and stony drifts. The sand consists of rounded grains of quartz, and is arranged in long low ridges. Between these ridges are open clay-flats or "clay-pans" formed of a yellow or reddish clay. Both sand and clay have been derived from the slow sub-aërial weathering of the granite and crystalline schists which form the ranges. Near the latter the sand contains grains of feldspar, zircon, tourmaline, magnetite and hematite. But further away it consists of pure quartz. The feldspars decompose and form the basis of the clay and the various salts with which it is impregnated. (See infra.)

The sand hardens into a sandstone showing much cross-bedding and oblique lamination, as might be expected from its aërial origin. Through the rock are ferruginous bands in which are carbonized remains derived from surface vegetation. The denudation of this sandstone gives rise in part to the cliffs and table-topped hills so characteristic of Central Australia. Throughout the continent such deposits are now forming but similar conditions have produced the same formation at other epochs. Thus in New South Wales such a sandstone is found many feet in thickness, and containing remains of ferns and cycads. They lie unconformably on the Permian and Liassic coal-beds, and evidently belong to the Lower Mesozoic. In Queensland they overlie the Cretaceous beds and, according to Tenison-Woods, are Tertiary. In the interior basin there is a complete gap between these beds and the Mesozoic rocks. They, as we have said, are forming at the present day, and probably have been so doing ever since the Mesozoic beds arose from the sea. The plant remains of the beds in the interior, as far as I have examined them, are not preserved well enough for identification. But here and there throughout the interior are found remains of the gigantic marsupials — Diprotodon, Nototherium and Phascolomys. These animals probably lived in the latter part of the Tertiary and early and middle Quaternary.

Alternating with the sand deposits are plains composed of stony drift. This is, for the most part, derived from the destruction of the æolian sandstones in their turn. In other cases, however, near the confines of the desert, wherever the crystalline rocks outcrop, it is derived from them. The boulders and pebbles lie thickly strewn on the surface, and are stained a dull red from the presence of the oxide of iron. It is owing to this col-

oration that the region covered by such deposits are known colloquially as "redstone plains." The drift is often many feet in thickness, and contains silicified wood and casts of existing land and fresh-water shells. It is being, and has been, formed synchronously with the æolian sandstones, and in many places the latter merges indefinably into the stony drift.

Following the course of the many dry watercourses which intersect this region, are immense deposits of alluvium. Two distinct formations can be recognized; an older and much the larger, and a smaller recent one. The lower formation consists of beds of sand, gravel and clay. The stratification varies from the most regular deposits to beds showing oblique lamination and flow and plunge structure. These deposits extend some distance on each side of the watercourses, and vary greatly in thickness. It is in these beds that the most abundant remains of the extinct marsupials are found. They extend laterally far beyond the limits of the more recent deposits which overlie them. The latter consists of fine-grained, thin-laminated alluvium. It contains no remains of Diprotodon, &c., but existing fresh-water shells such as Anodon, Paludina, Physa, &c., are abundant. It is formed by the deposition of sediment which the periodic floods bring down. Such, as far as is now known, is the structure of Central Australia.

At the close of the Archæan age the rocks which we have described as belonging to that age, were crystallized, folded and raised above the surface of the primeval sea, forming islands which probably have not since been completely submerged. After this elevation followed an immense period of quietude, during which vast beds of sediment derived from the erosion of these rocks, were deposited in a Palæozoic sea. Then at the end of the Cambrian or Silurian period another elevation occurred, and the rocks forming the Flinder's range were crystallized and upheaved. As I have said, at the northern extremity of this formation the Mesozoic rocks lie unconformably on it; so that there is a complete gap between. It is probable, however, that the Mesozoic beds are underlaid by Devonian and Carboniferous deposits. The structure of the eastern border region lends probability to this view. At any rate the whole lapse of time between the upheaval of the Cambrian or Silurian rocks until the close of the Jurassic, must have been, in the interior basin, a period of

slow oscillation and general quiet, during which beds of sediment were formed slowly at the bottom of the sea. At the close of the Palæozoic the eastern border and perhaps the western was elevated, thus forming an interior sea and foreshadowing the form of the continent. Another period of repose then followed until at the close of the Jurassic a large disturbance occurred. Land slowly emerged from the central part of the sea around the island of Archæan rocks now known as the Peake range. Contemporaneously with this upheaval vast floods of felsite were poured out through a line of fracture trending north and south on the western boundary of this region of elevation. Then came another period of rest, during which the waves and currents of a Cretaceous sea worked away at these new rocks. On the west side vast beds of kaolin were formed, derived from the felsitic rocks. In the remainder of the sea the conditions were much the same as in the Jurassic period, and similar beds were formed. But the fauna shows a gradual change in the life dwelling in the seas, as might be expected.

Finally, at the end of the Mesozoic age, the whole of the interior basin was elevated above the sea, and though minor changes of level have occurred, has remained above ever since. During all these changes of level the southern portion of the continent had not yet appeared, except the southern extremity of the Flinder's range. But since the Miocene period the southern part of the continent was raised above the sea. Either contemporaneously or subsequently there was a large amount of volcanic disturbance. After this there was a subsidence, as is seen by the fringe of æolian sandstones which, for a short distance out to sea, surrounds the southern coast.

During Tertiary times there was a subsidence along the eastern border. According to Tenison-Woods there is a long fault at the edge of the Blue mountains, and for many miles north and south there is a down-throw which brings the Hawkesbury sandstone (Mesozoic) nearly to the level of the sea, where it forms the fiords and diversified scenery of Port Jackson and other parts of the eastern coast. The existence of the Great Barrier reef indicates a period of slow subsidence on the north-east coast during Tertiary times. The western coast seems to have also participated in the general upheaval at the close of the Miocene, as raised beaches have been noticed there. The interior basin has

probably been dry land since the close of the Mesozoic; at least there is no evidence of its having been submerged. As the land arose the rate of elevation varied, occurring more rapidly in some places than in others. Consequently the interior sea would be changed first into an archipelago and this changed slowly into dry land, containing small inland seas, which gradually became large lakes such as Lake Eyre, Torrens and Gairdner. During the early half of the Quaternary the climate was moister, and consequently was better adapted for animal and vegetable life than at the present day. That it was the case is shown by the greater thickness and structure of the lower alluvial deposits, and also by the bones of the great marsupials found in them. These animals must have had a more luxuriant vegetation to feed upon than now exists. The climate probably, through the elevation of the southern border and other causes, gradually became more and more arid until it reached the present stage. The giants of earlier days have passed away, and strangely enough, as if nature delighted in abrupt antitheses, they are replaced by some of the smallest forms of the order of animals so characteristic of Australia.

Although the whole of this region is remarkably arid, the surface is intersected by innumerable watercourses which, though dry for the greater part of the time, periodically are filled by flood-water from the ranges. In the eastern part of the basin these creeks arise on the slope of the Queensland cordillera and flow westerly into Lake Eyre. From the north-west flow the Peake, Neales and others. Smaller creeks flowing in the same general directions are abundant. They either die out altogether or unite with the larger ones, or end in the salt lakes so common throughout the region. The salt lakes are generally but little more than large clay-pans where the water has periodically accumulated and then evaporated, leaving a deposit consisting of various salts. Some, however, are larger, and like those I have mentioned, are true lake basins. The true lakes are never I believe, completely dry, but the water becomes very low and intensely salt and bitter. Every flood as it comes down spreads out on the flats bordering the creeks, and extending laterally, in some places several miles, quickly evaporates, leaving a deposit of earthy sediment, and finally a thin deposit of the salts. This process is repeated time and again until considerable beds are formed. If the flood

is a large enough one the water finally finds its way to the large lakes (principally to Lake Eyre). These lakes, if the flood is very heavy, become tolerably fresh, and stay so until through loss of water by evaporation (none of them have outlets) the water again becomes salt. As evaporation proceeds the water slowly recedes, leaving a dazzling white incrustation, and sometimes a layer of dead fish which have been brought down by the flood, and when the water became too salt have been compelled to succumb.

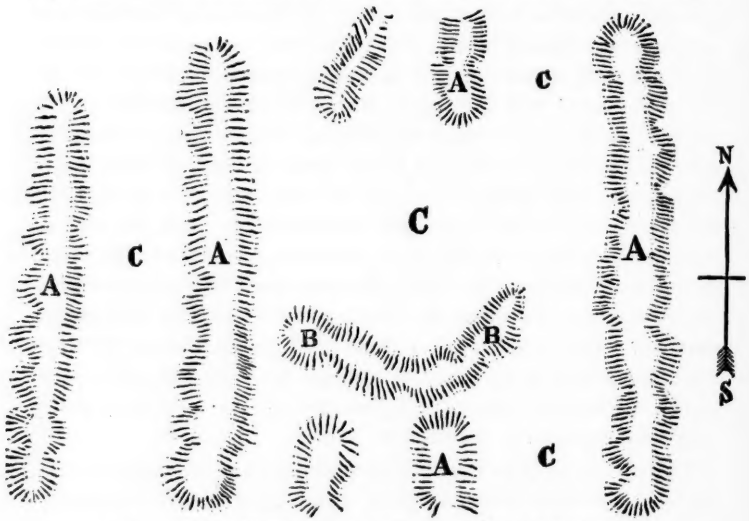
The lakes and clay-pans accordingly, unless seen in flood time, are generally a painfully white plain fringed by a few sickly Acacias. The salts are of different kinds; the most abundant one deposited is sulphate of lime (gypsum). The general form of crystallization of this salt is the common monoclinic twin or arrowhead crystal. Often, however, it is found in large transparent slabs and in a fibrous state. The next in importance among the salts are the carbonates of lime, magnesia and soda; the chlorides of sodium and magnesium, and the sulphates of magnesia and soda and iron. All these are derived from the decomposition of the rocks forming the ranges from whence the watercourses arise and from the denudation of the outcrops of the Mesozoic rocks which underlie the whole region. The actual amount of rainfall on the eastern and western slopes of the basin (especially the eastern) is largely in excess of the drainage by the watercourses, so there must be a large portion which soaks into the ground and drains away along the incline towards the interior, where it accumulates under great pressure. That this is the case is shown by the existence of a line of cold and thermal springs that extends north and south through the central basin. That the water comes from a great depth is evident from the fact of their temperature and the mounds of travertine they have built for themselves. The overland telegraph line nearly follows the line of outcrop of these springs. This line is also the outcrop of the crystalline schists forming the Peake range. Another line of springs extends in an east and west direction and follows the overlap of the Mesozoic rocks upon the Palæozoic schists of the Flinders range. The explanation is simple. The water coming from the north-west and north-east flows along down the inclines toward the central basin until it meets with a barrier in the schists of the Peake range. It cannot pass through them, and

accordingly it is forced to the surface by hydrostatic pressure. Consequently there is a double line of springs following the outcrop of the schists (see figures *ante*). A great deal of the water flows on further south until it is obstructed by the Palæozoic rocks of the Flinders range, whereupon it comes to the surface, forming an east and west line of springs (see Fig. 4). The quantity of salts contained by the water varies a good deal, but is always considerable. The principal salts are the carbonates of lime and magnesia. The travertine deposits are immense, and in some places form hills 200 feet high. The general form of the hills is that of a truncated cone. On the summit is a clear basin of water fringed with rushes, and down one side a stream of bright clear water trickles, soon to be re-absorbed by the parched ground. Bubbles continually rise to the surface of the pool, and are generally caused by the liberation from the water of carbonic acid gas. In other cases it is marsh gas, derived by the decomposition of the vegetable matter in the pool. When the water issuing from a spring has built a mound up to a considerable height, the pressure not being great enough to force it any higher, the travertine forms over the top, closing it completely, the spring then breaks out anew near its base. Mounds can be seen in every stage of evolution, from one the size of a bee-hive to one long deserted by water, standing alone like a huge melancholy sentinel. In these mounds are found remains of Diprotodon, &c. The conclusion is plain that an abundance of water could be procured by artesian borings through the rocks occupying the central desert, and possibly in this way the country may be developed in the future.

The topography of the interior is dismal and monotonous to a degree. In every direction from Lake Eyre the land gradually rises. The sandhill country predominates around the lake, but occasionally there are patches of stony plains. Both the sandhills and the intervening clay-pans are sparsely covered with low thickets or "scrub" of Eucalyptus, Acacia, Melaleuca and Cryptandra. Along the watercourses a few stunted gum trees are found (Eucalyptus). The stony plains, though a little diversified by the table-topped hills, are even more desolate in appearance. From north to east from the lake this is the character of the country for hundreds of miles. Ridge after ridge of sandhills covered with sparse vegetation, with here and there a dry clay-

pan or salt lake glistening painfully white under the fierce sun; no animal life save a few kites (*Milvus affinus* and *Elanus scriptus*), the never-absent crow and mayhap a forlorn sandhill wallaby (*Bettongia grayi*), and the deceitful mirage making everything seem weird and unreal. Such is the sight that greets the unhappy traveler until his eyes grow weary and his heart grows sick, yearning after cool streams and shady places.

The table-topped hills are generally derived from the erosion of outcrops of the Cretaceous and Jurassic rocks; in other cases from the compact æolian sandstone. The sandhills trend nearly north and south, generally a few degrees east of north. They show the true sand-drift structure, and have a sloping and an abrupt side. The direction of the trend is uniform over large areas.



A–A, parallel sandhills; *B–B*, crescent sandhills; *C–C*, clay flats.

If a sandy flat, to which the wind has free access, is examined, it will be seen that the sand has been blown into a series of ripples or ridges, whose long axes are at right angles to the direction of the wind, and on examining them closer it will be found that the side towards the wind is sloping and the opposite abrupt. Here then we have in miniature the sandhill country. The prevailing winds throughout the region are westerly and north-westerly, and the ridges trend at right angles with their sloping sides facing to the west or north-west. Where there is a decided variation in

the direction of the wind the sandhills also vary. The drifting sand has been arrested in its course by the bushes and other vegetation, and thus the sandhills have been gradually built up, although they have often been cut away and re-deposited, thus giving rise to the irregular position of their layers. Such is the general surface formation of the sandhill country, but here and there among the parallel ridges are solitary crescent-shaped sandhills whose long axes are at right angles to the prevailing system of hills. Facing the concave side of this variety of sandhills there is always a clay flat, at the other end of which the parallel sandhills re-commence, as seen in the sketch.

In the above sketch the concavity of the sandhill *B–B* is shown facing to the north; quite as often, however, they face to the south. The clay flat is always opposite to the concave side. These sandhills are usually several miles apart. What their origin is I cannot say. They possess the same structure as the normally built ones. It is possible that they may be the remains of another system of sandhills which by an alteration of climate producing a great change in the general direction of the prevailing winds, have been swept away and a new system formed. But if this is the case, why the crescent shape and why the variation of position among them? They have certainly not been formed by water, nor has their shape been modified to any great extent by its action, for if that was the case some traces would be left. And besides they are generally situated among the sandhills far away from any watercourse. There must be some cause for their existence. What that cause is I must admit is a mystery to me. I think the subject worth investigation, for it is certainly remarkable that there should be these anomalous cases scattered here and there through a region unique for its uniformity.

In the north-western portion of the basin, where the Cretaceous beds of kaolin occupy the surface, denudation has worn the soft clays into a great variety of fantastic shapes. Minarets, castles, temples and even grotesque images of man and beast are replicated on every hand in the greatest variety of dazzling colors. These are every shade from jet-black to snow-white. Gorgeous purple, delicate pink, rose red and somber brown, green and blue are mingled together with amazing confusion and prodigality. It is a riot—a mad dance—a very *carmagnole* of color. It would seem as if some mischievous elves had been rioting in nature's

color-laboratory and then affrighted by their pranks had fled, leaving all this splendor blazing unknown under the fierce sun of the desert—for a desert it is in everything save color. The Arkaringa creek, which arises in the Musgrave range, in its southerly flow has cut itself a passage through these beds. On each side are cliffs 400 or 500 feet high wrought into the strangest of shapes and bedecked with the gaudiest colors. It seems as if nature wished to show what she could do when she took the artist's tools in her own hand. But the lesson is lost, for few mortal eyes, save now and then a wandering black fellow, more intent on hunting lizards for his dinner than æsthetic worship, have ever beheld this gigantic sport of Dame Nature. But the eye tires of it, and soon is fain to turn for rest to the somber black-green of the scrub foliage. With the exception of this brilliant tract all the rest of the interior consists of the dullest and most prosaic country; sandhills and stony table-lands *ad nauseam.*

Such is a brief and necessarily imperfect description of the great Australian desert. We can see that Australia, though often called paradoxical, is not so, but conforms to the laws of continental development. The outlines of the continent have existed from the earliest times, and the whole has gradually been built up, step by step, until we find it as at the present time. There has been no paradoxical break in nature's handiwork nor in her laws. We see here the same grand, impassive uniformity, the same disregard for time that ever characterized her work, whether it be the molding of a germ of life, the elevation of the Alps or the creation of a solar system. Future researches may amplify the conclusions drawn in this paper, but the main facts will remain unaltered.

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THE NUMBER OF SEGMENTS IN THE HEAD OF WINGED INSECTS.[1]

BY A. S. PACKARD, JR.

BY a study of the structure of the head of adult insects it is very difficult, if not impossible, to determine the number of segments in the head of winged insects. The number as given

[1] Extracted from the forthcoming third report of the U. S. Entomological Commission.

by different authors is very variable, while it is popularly supposed that the head corresponds to a single segment, and that the different pieces are simply "subsegments." We will quote from Newport, article *Insecta*, in Todd's Cyclopædia of Anatomy and Physiology, the views perhaps generally entertained on this subject.

"According to the investigations of the most careful observers, Savigny, Audouin, Macleay, Kirby, Carus, Strauss-Durckheim, Newman and others, every segment of the perfect insect is made up of distinct parts, not always separable from each other or developed to the same extent, but existing primarily in all. It is also believed that the head itself is formed of two or more segments, but the exact number which enter into its composition is yet a question. So uncertain are the opinions held upon this subject, that while Burmeister recognizes only two segments, Carus and Audouin believe there are three, Macleay and Newman four, and Strauss-Durckheim even so many as seven. These different conclusions of the most able investigators appear to have arisen chiefly from too exclusive examinations of the head in perfect insects, without reference to the corresponding parts in larvæ. It is only by comparing the distinctly indicated parts of the head in the perfect insect with similar ones in the larva that we can hope to ascertain the exact number of segments of which it is composed. In the head of the perfect insect there ought to be found some traces of all the segments which exist in the larvæ of the same species, and in that of the more perfectly developed larvæ that undergo a true metamorphosis there ought in like manner to be found the rudiments of all the segments in the least perfectly developed. Now, the common larva of the Dipterous insect, the maggot of the flesh fly, is one of the lowest forms we have yet examined, and we have already seen that its head appears to be formed of four and perhaps even of five segments. This is the greatest number yet noticed in the head of the larva of any species. If, therefore, we can trace the like number in the head of a perfect insect, we may fairly conclude that this is the normal number of segments throughout the class. The head of the great water-beetle, *Hydrous piceus*, is remarkably well fitted for exemplifying the number of segments of which the head is originally composed, the remains of four of the segments being distinctly marked; and it also affords us a proof of the correctness of the opinions advanced by Savigny and others, that the organs of manducation are the proper articulated members of distinct segments, and are perfectly analogous to the proper organs of locomotion.

"We shall first describe the parts of which the head is composed, and then endeavor to explain the manner in which these parts have been developed from several segments to form the perfect cranium and its appendages. It has hitherto been customary

with naturalists to designate the head the first segment of the body, and as every change in the nomenclature of a distinct part ought always to be avoided, unless positively required, through fear of creating confusion, we shall not deviate on the present occasion from the established mode; but when speaking of it as a whole shall consider it the first segment, while the aggregation of segments of which it is composed we shall designate individually *subsegments*, distinguishing them numerically in the order in which they appear to exist in the earliest condition of the fœtal larva."

If we apply the law enunciated by Savigny, and which holds good as a rule throughout the hexapod insects, *i. e.*, that each segment of the body of insects bears but a single pair of jointed appendages, we find that as the head of insects is provided with four pairs of appendages, viz., the antennæ, mandibles, first maxillæ and labium (or second maxillæ), there must be four corresponding segments.

While the subject becomes clearer when, with Newport, we examine an insect in the larval state, the fact that the head of insects is really composed of but four segments becomes readily demonstrated when we examine the embryo at an early stage of its existence. In our embryological studies on the Thysanurous insects (Isotoma), on Pseudoneuropterous insects (Diplax), on the beetles and the flea and Hymenoptera (*Nematus ventricosus*), our attention was specially directed to this point, and it appeared very plain and easily demonstrable that the head of winged insects of all orders consists of four segments (arthromeres) and no more.[1]

An inspection of the figures published by the different writers on the embryology of insects appears to confirm this view, and in our "Guide to the Study of Insects" (p. 20) we have given a tabular view of the four segments of the head and the appendages they bear. This view is fully confirmed by our studies on the embryology of the locust. The antennæ and mouth-parts are outgrowths budding out from the four primitive segments of the head; the antennæ grow out from the under side of the procephalic lobes, and these should therefore receive the name of antennal lobes. In like manner the mandibles and first and second maxil-

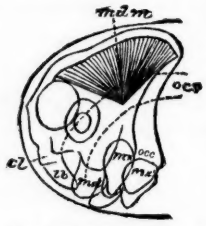
[1] See Embryological studies on Diplax, Perithemis and the Thysanurous genus Isotoma, by A. S. Packard, Jr.; Memoirs Peab. Acad. Sc., Salem, 1871, p. 21; also Second Memoir, 1872. This view was stated in the author's "Guide to the Study of Insects," second edition. Graber (Die Insekten, München, 1879, p. 430) also states that the head is composed of four segments.

læ arise respectively from the three succeeding segments. The figures by Kowalevsky and Bobretsky and by other observers, as well as those of the earliest stages of Diplax, Pulex and Attelabus which we have published, show that the cephalic segments are first indicated, and that subsequently those appendages bud out from the under side at a point situated on each side of the sternal or median line of the body. It appears that the appendages arise between the sternal and pleural portions of the segment.

There, however, remains a portion of the head in front of the procephalic or antennal lobes which afterwards becomes the clypeus and labrum or upper lip. Do these parts belong to the antennal segment, or are they rudimentary portions of a segment situated in front of our first segment? This lobe or outgrowth is evidently a single unpaired lobe which grows out in front of the antennal lobes, and is seen to form the front or upper wall of the mouth. We regard it as the tergal portion of the antennal segment, and the procephalic lobes as probably forming the pleural portion of the segment. The procephalic lobes, then, bearing the antennæ below, and higher up on the sides the eyes and ocelli, become the epicranium of the larval and adult insect. It follows, therefore, that the head of larval and adult insects is made up mostly of the first or antennal segment, and that the epicranium is the pleural portion of this segment, while the clypeus and its offshoot, the labrum, is the dorsal or tergal portion of this segment.

The only other portion of the head of certain adult insects which remains to be accounted for is the so-called "occiput." This forms the base of the head of Corydalus, a Neuropterous insect, which, however, is more distinct in the larva. In most other insects the occiput is either obsolete or soldered to the hind part of the epicranium. We have traced the history of this piece (sclerite) in Diplax, a dragon fly, and have found that it represents the tergal portion of the fourth or labial segment. In our memoir on the development of this dragon fly, Pl. 2, Fig. 9, the head of the embryo is seen to be divided into two regions, the anterior, formed of the first three segments, and the posterior, formed of the fourth or labial segment. This postoral segment at first appears to be one of the thoracic segments, but is after added to the head. A. Brandt's figure of *Calopteryx virgo*, Pl. 11,

Fig. 19, represents an embryo of a stage similar to ours, where the postoral or fourth (labial) segment is quite separate from the rest of the head. The accompanying figure, copied from our memoir, also shows in a saw-fly larva (*Nematus ventricosus*) the relations of the labial or fourth segment to the rest of the head. The suture between the labial segment and the pre-oral part of the head disappears in adult life. From this sketch it would seem that the back part of the head, *i. e.*, of the epicranium, may be made up in part of the tergite or pleurites of the mandibular segment, since the mandibular muscles are inserted on the roof of the head behind the eyes. It is this segment which in Corydalus evidently forms the occiput, and of which in most other insects there is no trace in larval or adult life.



Head of embryo Nematus, showing the labial segment, *occ*, forming the occiput; *cl*, clypeus; *lb*, labrum; *md*, mandible; *mdm*, muscle of same; *mx*, maxilla; *mx'*, 2d maxilla (labium); *oes*, œsophagus.

It appears, then, that the epicranium, or that piece (sclerite) bearing the eyes, ocelli and antennæ and in front the clypeus and labrum, is formed from the original procephalic lobes, and represents the first or antennal segment, and is pleural, the clypeus and labrum being the tergal portion of the segment; while the remainder of the original or primitive segments are obsolete, except in those insects which retain traces of an occiput or fourth cephalic tergite. All of the gular region of the head probably represents the base of the primitive second maxillæ.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— The society of mutual autopsy has presented reports on the brains of several of its deceased members to the Anthropological Society of Paris. These reports are of great interest, as being among the very few accounts which we possess of the structure of the brain in persons whose characters are known to the investigators. It is clearly the only means of acquiring the foundations for a true physiology of the thinking part of the brain, which we possess. Unfortunately we are only on the threshold of the subject, owing to the almost absolute neglect of

this important branch of research. We know of no reason why the anatomists and physiologists in every city in the world should not organize themselves into mutual autoptical societies. We will then have some basis for a true anthropology and a true metaphysics.

From a sentimental standpoint, as well as from an intellectual one, it appears to us better to utilize this beautiful organ in this way, than to permit it to take the course prescribed by the unrelenting forces of nature. Thus may science rob the grave of some of its most distinguished victims. Not that human sensibility does not shrink from applying the knife to the organ that once glowed with the fire of thought and feeling. But the alternative is much more repulsive, and has been the theme of unavailing regret since man learned to admire and love his fellowman.

One of the members of the Anthropological Society expressed his dissatisfaction with the work of the Mutual Autoptical Society, on the presentation of the report on the brain of Louis Asseline. He remarked that the statements of the report show clearly the immorality of such a society. He could not compliment it on the discovery of a simian characteristic in this brain. Such results, he said, were not happy. To this M. Topinard made the following just reply: "'You are not happy in your results.' 'Happy,' in what sense? It is not to be supposed that we pursue a defined object, or that we have a ~~course~~ cause to sustain. We seek the truth and nothing more. It makes no difference whether we shall discover approximations or distinctions from the animals. The only indication of distinction from the animals is to see correctly, and not to nurse preconceived ideas and illusions. The Anthropological Society does not belong to any sect, neither in one sense nor in another."

—— It is undoubtedly the opinion of the more advanced teachers of high and normal schools that some time should be given in the common schools to the study of biology, *i. e.*, of plants and animals. The study of plants is perhaps easier to handle in schools and with large classes of children than that of animals, and should precede the study of the latter. Children of from eight to ten years can easily be taught to understand the parts of a flowering plant, the roots, stem, leaves, corolla, petals, pistil, stamens and anthers; and flowers of different species can

be obtained in sufficient quantities to enable teachers to place one in the hands of each child. What we have to suggest refers chiefly to the study of animals.

The popular conceptions of the study of zoölogy in schools, as we have learned from conversation with elderly gentlemen, life-long teachers of the old regime, is, that it consists in looking at a few stuffed birds and other specimens of the taxidermist's art, and reading about them in books and memorizing those dreadful objects, zoölogical charts. From such a standpoint they do not think much of the study of zoölogy as a discipline. In fact, the presentation of an essay on the study of zoölogy as a mental discipline, before a meeting of teachers, was received with mild incredulity. Nothing but sums and grammatical rules will, in the mind of the average school-teacher, meet the demands of the times.

And so the first difficulty we have to contend with is the ignorance and often the prejudice of the teachers. We have few, very few men or women, who know anything of zoölogy. It is taught in the higher schools from books and charts. Where it is taught as an elective in college, it is studied but a few hours a week for one term or perhaps half a year. A young man graduates and teaches mathematics and Latin and Greek, after having studied it from eight to ten years. In those directions he has had a special training. Were a fair amount of college time given to biological study, we should see these studies introduced into the common schools and have teachers fairly competent to teach them.

Our remedy for the deficiency of trained biological teachers would be something after this fashion. A slight knowledge of physical geography and of botany and zoölogy should be required to enter college; some time should be given to these studies, at least as an elective, each year after entering. In this way competent teachers will be graduated.

In the common schools the study of animals should be graded in somewhat the following way: In the primary schools the children up to ten years should learn the parts of a plant; they should also be taught object lessons involving the handling of shells, beetles, should watch a fish alive in a jar, examine stuffed birds; and they should be taught to compare the more obvious parts of a bird with those of a dog, cat or horse.

In the grammar school, besides simple lessons about plants, children from ten to fifteen years of age should have at least a weekly lesson on animals, beginning with clam, quohog and oyster shells, snail shells, beetles and butterflies; they should see, handle and draw a caterpillar, chrysalis and a butterfly, so as to understand something of the metamorphosis of a butterfly. They should also see a fish, draw it, learn the name of the different fins, see the gills, and the teeth on the inside of the mouth; a frog

and its tadpole should be shown; a bird and its egg, and a cat or dog, and they should compare the limbs and other parts of a quadruped with their own arms, hands, legs and feet. A lesson once a week through each year of grammar-school life could be well taken from the time given to geography, in which the pupil is forced to learn, besides what is valuable and necessary, a mass of useless information, two years being given to the study of a single book. We are convinced that geography, as usually taught, is a sham and a delusion, the books contain a great deal of useless stuff, and at least a quarter of the time devoted to the study might be given to natural history.

Having thus had at least a weekly lesson in zoölogy in the three years of grammar-school life, and having learned the different parts of a clam shell, and the parts of the animal, without dissection, and so on with the beetle, butterfly, fish, frog, bird and mammal, the pupil enters the high school. Here the boy or girl can, with the aid of a competent teacher, take a rather more advanced course with the same species of animal he has already had. The clam can be in part dissected; the lobster or crayfish and beetle, butterfly and higher animal can be partially dissected. In the case of a fish the student can, in connection with the study of physiology, dissect the animal and see for himself the heart, stomach, intestine and brain, and so with a chicken or bird of any sort. We have with much satisfaction taught a class of boys from a high school to dissect a lobster, and they enjoyed the work. By spending but a single hour a week, and confining the class to but few objects, they can obtain a fair idea of zoölogy, which will be a pleasure and involve a fair share of mental discipline, and have taken but little time from other studies.

A candidate for admission to college, and but few high school graduates go to college, should pass an examination involving a knowledge of but a few animal types, such as a clam, a lobster, a beetle, fish and bird; with this knowledge he can then appreciate an advanced course in general zoölogy, involving the laws of morphology, reproduction, embryology and zoö-geography, and by the senior year be able to digest the laws of the geological succession of animals, and of their evolution as well as of palæontology, for without a knowledge of these topics no young man has had a liberal education, and the young man who has not had such a course will be incompetent to teach biology in the common schools.

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RECENT LITERATURE.

NEWCOMB AND HOLDEN'S BRIEFER ASTRONOMY.[1]—Modern astronomy is now so closely allied in some of its methods, and

[1] *American Science Series, Briefer Course. Astronomy.* By SIMON NEWCOMB and EDWARD S. HOLDEN. New York, Holt & Co. 12mo, pp. 338.

touches in so many ways upon the science of geology, that a brief, compendious, general treatise like this, without the mathematics, is useful to the geologist. He will be interested in the chapters relating to the moon and particularly the tides and their effects upon the earth's rotation, since these subjects are now so much discussed by speculative geologists. So also the chapters on meteors, and especially the last chapter on cosmogony, including the statement of the nebular hypothesis, will be valuable as giving the opinions and conclusions of one of the leading astronomers of the day, while the concluding paragraph will be of interest as showing how the subject is treated:

"It must be understood that the nebular hypothesis, as we have explained it, is not a perfectly established scientific theory, but only a philosophical conclusion founded on the widest study of nature, and pointed to by many otherwise disconnected facts. The widest generalization associated with it is, that so far as we can see, the universe is not self-sustaining, but is a kind of organism which, like all other organisms we know of, must come to an end in consequence of those very laws of action which keep it going. It must have had a beginning within a certain number of years which we cannot yet calculate with certainty, but which cannot much exceed 20,000,000, and it must end in a chaos of cold, dead globes at a calculable time in the future, when the sun and stars shall have radiated away all their heat, unless it be re-created by the action of forces of which we at present know nothing."

NATURE STUDIES.[1]—This is a compact reprint of essays by some of the leading English popular-science writers which appeared in *Knowledge*. They are light, readable and timely papers, and vastly superior to much of the literature sold in bookstalls and railroad cars. As for being "studies," however, one may smile when we find Mr. Proctor who, we believe, started as an astronomer, writing, very pleasantly to be sure but perhaps not always authoritatively, on Darwin, Newton and Darwin, the Fiji islands, strange sea monsters, intelligence in animals, brain troubles and thought reading. The bare thought of one individual assuming the rôle of an expert and putting forth "studies" as only such an expert should, on such a concatenation of subjects, is enough to take one's breath away. The publishers, moreover, who do not seem to be over strong evolutionists, appear in a preface to mildly question whether some of the facts stated under the head of "found links" may not be "doubtful." We find, however, that what Professor Wilson writes upon is generally correct and very pleasantly written, though he is a compiler, and his sources are purely English. His readers are left almost entirely in the dark

[1] *Nature Studies*. By GRANT ALLEN, ANDREW WILSON, THOMAS FOSTER, EDWARD CLODD, and RICHARD A. PROCTOR. New York, Funk & Wagnalls. Standard Library No. 91. 12mo, pp. 252. 25 cents.

as to what has been done in Germany, and especially Belgium, France and the United States.

Mr. Grant Allen also, like a busy bee, after visiting the "honey ants," takes up with "hyacinth bulbs" and then solaces himself with "a winter weed," and in the spring time discourses on "the first daffodil," and later on in the book, whether in the vernal season or no, discovers "the origin of buttercups," and later on, perhaps in some autumn number of *Knowledge*, tells us "what is a grape."

The book is what in boarding-house idiom would be styled excellent "hash," well-seasoned for the most fastidious stomach, even when called upon to digest "strange sea monsters."

STUDIES FROM THE BIOLOGICAL LABORATORY OF JOHNS HOPKINS UNIVERSITY.—This number completes the second volume of these important "studies." Among the strictly zoölogical papers are Professor E. A. Birge's notes on the development of *Panopæus sayi*, with four plates; the structure and growth of the shell of the oyster, by H. L. Osborn, with one plate; the nervous system of Porpita, by H. W. Conn and H. G. Beyer, M.D., with one plate; notes on the Medusæ of Beaufort, N. C., Part II, by Professor W. K. Brooks. Under the head of histology would come the paper by Professor A. H. Tuttle on the presence of ciliated epithelium in the human kidney.

The physiological papers are of much value; they are the following: On the effect of variations of arterial pressure on the duration of the systole and the diastole of the heart-beat, by W. H. Howell and J. S. Ely, with one plate; the action of ethyl alcohol upon the dog's heart, by Professor H. N. Martin and Lewis T. Stevens, and lastly, a reprint from the Proceedings of the Royal Society, London, of Professor Martin's paper on the direct influence of gradual variations of temperature upon the rate of beat of the dog's heart.

BULLETIN OF THE ILLINOIS STATE LABORATORY OF NATURAL HISTORY.—This is the sixth bulletin issued by this useful institution in May last, and contains four papers by Mr. S. A Forbes, the director, as follows: I. The regulative action of birds upon insect oscillations; II. The food relations of the Carabidæ and Coccinellidæ; III. The food of the smaller fresh-water fishes; and IV. The first food of the common white-fish (*Coregonus clupeiformis*). The first two papers have already been noticed in this magazine, and the entire series are fresh and valuable contributions to biology, and contain the result of extensive and patient observation.

HERRICK'S TYPES OF ANIMAL LIFE SELECTED FOR LABORATORY USE IN INLAND DISTRICTS.—This is the first part of this publication, and is devoted to the Arthropoda. The general anatomy of the larva of Corethra, of a Copepod (*Canthocamptus minutus*),

and of *Gammarus limnæus* and *Hyalella dentata* are given, the student's attention being drawn to those points not requiring dissection. The figures might have been better drawn and engraved, so that the student should have a better model of such work before him, but the brochure will be useful, and we are glad to see such a publication adapted for the use of American students.

MOEBIUS AND HEINCKE'S FISHES OF THE GERMAN OCEAN.—This appears to be an excellent brief account of the marine fishes of the German ocean prepared for popular use, and issued by the Commission for the scientific investigation of the German ocean, whose headquarters are at Kiel. Every species described is accompanied by a good outline figure. There is a map showing their geographical distribution. It is published by Paul Parey, Berlin, 1833, and contains 206 pages.

RECENT BOOKS AND PAMPHLETS.

Egleston, T.—The method of collecting Flue-dust at Ems on the Lahn. Ext. Trans. Amer. Inst. Ming. Eng., 1883.

——Leaching Gold and Silver ores in the West. Ext. idem.

Bower, A.—The Bower Barff Process. Ext. idem.

Boyd, C. R.—The Ores of Cripple creek. Va. Ext. idem.

Spilsbury, E. G.—Gold Mining in S. Carolina. Ext. idem.

Coggin, F. G.—Copper Slime Treatment. Ext. idem.

Witherow, J. P.—The Blast Furnace of the Crozer Steel and Iron Company at Roanoke, Va. Ext. idem.

Troilius Magnus.—On the determination of Manganese in Spiegel, Ferro-manganese, Steel, etc. Ext. idem.

Mackintosh, J. B.—The volumetric determination of Manganese. Ext idem.

Raymond, R. W.—The Divining Rod. Ext. idem.

——The natural Coke of Chester county, Va. Ext. idem.

Stetefeldt, C. A.—The Shelf Dry Kiln. Ext. idem.

McCreath, A. S.—The Iron ores of the Valley of Virginia. Ext. idem.

Rothwell, R. P.—The treatment of Gold-bearing arsenical ores at Deloro, Ontario, Canada. Ext. idem.

Hitchcock, C H.—The geological position of the Philadelphia gneisses. Ext. idem.

Henderson, C. H.—The Copper deposits of the South Mountain. Ext. idem.

Blake, W. P.—Mining and storing Ice. Ext. idem.
All from the institute.

Hunt, T. S.—The decay of Rocks geologically considered. Ext. Amer. Jour. of Science, Sept., 1883. From the author.

Broadhead, G. C.—The Carboniferous Rocks of Eastern Kansas. Ext. Trans. St. Louis Acad. Science, 1883. From the author.

Bennett, A. W.—On the constancy of insects in their visits to Flowers. Ext. Linnean Soc. Journal, 1883. From the author.

Ryder, J. A.—On the Thread-bearing Eggs of the Silversides (Menidia). Ext. Bull. U. S. Fish Commission, 1883. From the author.

Drown, T. M.—Technical Training. An address to the Alumni Association of Lehigh University, June 20, 1883. From the author.

Dollo, M. L.—Quatrième Note sur les Dinosauriens de Bernissart. Ext. du Bull. du Musée Royal d'Hist. Nat. de Belgique. 1883. From the author.

——Note sur les Restes de Dinosauriens rencontrés dans le Crétacé Supérieur de Belgique, 1883. From the author.

Agassiz, A.—The Tortugas and Florida reefs. From Memoirs of Amer. Acad. of Arts and Sciences. June, 1883. From the author.

Geinitz, H. B.—Ueber neue Funde in den Phosphat lagern von Helmstedt, Büddenstedt und Schleweke, 1883. From the author.

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GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

ASIA.—A paper read before the Royal Geographical Society by Mr. E. C. Baber, Chinese secretary to H. M. Legation, Peking, corrects some erroneous ideas respecting that country. The six western provinces, the eastern boundaries of which coincide tolerably well with the 110th meridian, are everywhere mountainous and for the most part poor and sparsely populated, while the twelve eastern provinces are level, populous and well-cultivated. The untrustworthiness of the native census is apparent to any one who has lived long in China, and knows, on the one hand, the large extent of thinly-populated country, and, on the other, the character of the officials employed upon the census. By comparison with British India, Mr. Baber believes about 250,000,000 a fair estimate of the population.

Although the Chinese race has spread over so large a territory, and absorbed, more by its energy and superior civilization, combined with constant intermarriages, than by force, many native races, one race at least has in part remained independent. This is the Lolo, or as they call themselves, Lo-su and Ngo-su, the *Coloman* of Marco Polo. Though confined within a much smaller territory than in the days of Marco, an almost impregnable mountain country is still held by them, and from it they descend upon the lowlands to levy blackmail and take prisoners for ransom or as slaves. This they call taking "rent" for the territory they were dispossessed of some 200 years ago. They never intermarry with the Chinese, and this, more than their robust frames, warlike habits or strong fastnesses, has preserved their race intact. The Lolos still burn their dead, as in Marco's time. In the discussion which followed this paper, Sir T. Wade said, that after a residence of twenty years in Peking, he believed its population less than half a million, while the great fair or market town of Hankow could never have had more. The men of Kuang-lung and Kuang-si were easily distinguished from those of the rest of the empire, and Kuang-lung was not joined to the empire until six centuries after Christ. These people were not improbably a Malay immigration. While all other Chinese spoke of themselves as men of Han, from the dynasty of that name

[1]This department is edited by W. N. LOCKINGTON, Philadelphia.

which began to rule over the rest of China 200 B. C., the Cantonese and Fokienese spoke of themselves as men of Tang.

Mr. Colquhoun gives the area of the Shan States, which include all Indo-China lying between Yun-nan on the north and the Burmah and Annam ranges west and east, as 340,000 sq. miles, 80,000 in the independent Shan States, and 260,000 in Siam. Little is known of most of this region, yet it must be thickly populated, since the Siamese records give 6,000,000 as the number of able-bodied men in their territory.

A correspondent of the *North China Herald* describes a journey from Hankow, on the Yangtsze, to Chunching in Szechuen, 720 geographical miles distant. The mountainous country is entered by the first of the celebrated gorges shortly after passing Ichang, the highest port on the river open to foreign trade. In Szechuen the Yantsze is known as the Ch'uan Ho, or river of Szechuen, and flows through a succession of gorges in ranges which mostly run north and south. At Wan-hsien, 160 geographical miles above Ichang, a region of picturesque sandstone hills, covered from base to summit with poppy gardens, is reached. The people are polished in manners and courteous to Europeans. The province is suffering from drought at the same time that Hupeh is flooded. The course of the river from Wan-hsien to Chunching is a succession of reaches at right angles to each other in a sandstone formation. The towns and cities are built upon the cliffs.

Mr. Carl Bock has recently traveled from Bankok to the frontiers of the independent Shan States. Tschengmai, Kiangmai, or Zimmé as it is variously spelled, is the capital of the Shan States tributary to Siam, and is a fortified town of about 700,000 people, lying in a fertile plain of uninterrupted rice fields, at less than a third of a mile from the Me Ping, which is here 400 feet wide. It is of great political and commercial importance, and controls the trade of the States with Siam and British Burmah. The teak forests of the region are almost inexhaustible. From Zimmé Mr. Bock proceeded to Kiangtsen, on the Meikong, and on the borders of the independent Shan States. Mr. Bock's further progress was stopped by hostility aroused chiefly by his own indiscretion. A railway from Bankok to the Shan frontiers would pass through rich and populous districts.

An expedition sent from Saigon to explore the country between the Meikong and Annam, at about 14° N. lat. was compelled to return near the Cambodian frontiers on account of the hostility of the barbarous Mois, who inhabit the wilds between Cambodia and Siam. Among these people money is almost unknown, and their traffic is by barter. These Mois claim no descent from the races which have left behind them Angker Wat and other ruins to testify to their civilization, and appear to be independent, though the King of Cambodia is their nominal suzerain.

The Russian explorer, Konchin, has discovered that Kalitin was mistaken in supposing that the steppe between Charzhui and Uzboi was crossed by an ancient channel of the Oxus.

A considerable part of the basin of the Upper Irtish is annexed to Russia by recent conventions.

AFRICA.—A journey recently undertaken by the Earl of Mayo from Mossamedes, on the west coast of Africa, to Ekamba on the River Cunéné, throws much light upon the geography and race movments of that part of Africa. Portuguese influence extends to the Cunéné, where, at Humbé, there is a mission, while at Huilla, in the Sierra Chella, there is a fort and a Catholic college. Humpata, north of Huilla, is occupied by numerous Boer families, who after seven years of wandering from Pretoria, in the Transvaal, had reached this healthy and well-watered district in the highlands of the western barrier of Africa's central plateau, and had already, in the course of eighteen months, built comfortable stone or mud cottages with thatched roofs, and had constructed irrigation canals. The country between the Sierra Chella and the sea is, for the most part, barren, but the valley of the Gambos river, an affluent of the Cunéné, abounds in game of every kind. The Cunéné is a smaller river than would be imagined from its appearance on a map. At Humbé, some 200 miles from its mouth, it is not navigable for large boats in the dry season, there is a bar at its mouth which prevents the entrance of any vessel, and there are rapids about seventy miles from its mouth and large falls where it crosses the Sierra; but it is said to be navigable farther up its course. The curious Welwitschia is abundant near the coast between Mossamedes and the River Coroca, which is simply a sandy bed in the dry season, but a lagoon allows a small area to be farmed.

Between Mossamedes and the Sierra Chella, at Giraul, the perpendicular faces of the rocks are covered with almost pure sulphate of magnesia; to this succeeds basalt, which is followed by quartzose rock changing into quartzose granite.

The natives, from the seacoast to the Sierra, are Mundombes, speak a language belonging to the Bantu family, and are large cattle-keepers. The Munhanecas and Quipongos inhabit the country east of the Sierra. They keep cattle, cultivate to some extent, moving their villages when the soil is worked out, and are armed with poisoned arrows and assegais. South of the Mundombes live the Chibiquas, a tribe of hunters and cattle-keepers of Damara race, intermixed with Ovampos. These are savages pure and simple, wearing only beads and a leather apron. They have some very curious flat-headed iron instruments with which they sever the muscles above the hind feet of the elephant to oblige him to stand still, when they kill him with assegais.

Col. J. A. Grant, the companion of Speke, writes to the Royal

Geog. Society an interesting account of King Mtesa, whose death was reported in the papers of July 13th. That he was a very remarkable man is evident from the respect entertained for him by Grant, Speke, Baker, Stanley, de Bellefonds and other travelers, as well as by the discipline he maintained and the affection with which he was regarded by his people. He communicated his love of acquiring information to his people, and the habits of observation thus enforced have raised his people above other Africans. The population of Uganda proper is probably not over a million, but if the inhabitants of Karagweh, Usui, Unyoro and Usoga be included, the total may probably reach three millions.

The British government has annexed the territory lying southeast of Sierra Leone as far as Liberia.

Northward of Sierra Leone, on the Futa Diallon coast, the French have established several new stations.

Gerhard Rohlfs estimates the Jews in Africa at 220,000, in opposition to Brunialti, who placed them at 450,000.

Dr. J. Partsch, of Berlin, presents evidence to show that the shores of Tunis are not an area of elevation, as claimed by Th. Fischer. He states that the chief addition to the land is a hundred square miles of delta built out by the combined action of the River Medjerda (the ancient Bagradas) and wind action on the sands, since the third century. Carthage is still on a promontory close to the sea, with the remains of some of its harbor-works at the water's edge.

Mr. Thomson has been compelled to return to Taveta with his caravan on account of the hatred to white men among the Masai, aroused by the passage through the country of Fischer's caravan —a passage which was effected by force; some of the Masai, including a chief, were killed, and the young men vowed vengeance on the first weak caravan. The retreat was effected safely.

The caravan of Dr. Fischer consisted of 800 men, and must, therefore, have been formed by the union of other caravans with the 350 men Dr. Fischer took with him.

Dr. W. Junker was, when news was last received from him, still in the Niam-Niam country, at the residence of a chief named Semio.

The total length of the Niger, according to Commandant Gallieni, is over 2000 miles, the upper part, from the rocks of Sotuba, a little below Bammaka, to its head-waters, may be probably in part navigable for small steamers; the middle course, from the above named rocks to the falls of Busa, flows in numerous channels through a flat country, is the scene of an active river-trade in slaves, cattle, gold, etc., and is little known, while the lower course has often been ascended a considerable distance by trading vessels. Several of the towns are surrounded by well-constructed ramparts.

M. Roudaire, who with a party of engineers has been engaged in making borings across the lowland between the Mediterranean and the Algerian Chottes, is reported to have as yet met with nothing more formidable than sand, so that the interior sea may after all become a fact.

Max Buchner gives some curious particulars respecting the kingdom of the "muatiamvo," south of the Congo. The muatiamvo, or king, is not the only ruler, a second high authority is the "lukokessa," or queen, who is not, however, his consort, but entirely independent of him, with her own consort, the "shamoana," and numerous husbands of a lower order. The "muatiamvo," whose name is Shanana, or Naoesh-a-kat, has sixty wives. The country, about as large as Germany, can hardly have more than two millions of people.

Lupton Bey, governor of the Egyptian province of Bahr-el-Ghazal, has written to a relative in England to the effect that he is engaged in recruiting a negro force to act against the Mahdi, or False Prophet, who, with his army of Arabs and Arabized Nubians, is ravaging the provinces north of his government. For this purpose he especially relies on the short, thickset, red Nyam Nyams. When a light draught steamer now in course of construction at Khartum is finished, the terminus of navigation will be transferred from Meshra-el-Rek, near the junction of the Kyt with the Ghazal, to Wau, on the Djur tributary of that river, eighty miles further to the south-west. Lupton Bey describes the country around Anyower, to the west of 26° E. long., as well watered and with forests so dense that the sun is unable to penetrate the foliage. Elephants and monkeys abound. The natives belong to the Bunder Kretch, Aga and Gobo tribes, and are very low. The women are naked, the men wear a coarse waist-cloth.

Mr. Stanley was, on May 1st, preparing to start from Leopoldville with three steamers and many native canoes, for the Stanley falls. Mr. Johnston, who visited the Congo after accompanying Lord Mayo on his trip to the Cunéné, also reports that Mr. Stanley has formed alliances with various chiefs who own the territory along the north bank of the Congo for a long distance beyond Stanley pool, and has signed treaties with a view to checkmating M. de Brazza. Orders from Brussels have, however, been received to the effect that the rights acquired by the French upon the Congo are to be respected.

Kuilu, on the Loango coast, which M. de Brazza had intended to secure as the starting point for his direct road *via* the Niari valley to the navigable waters of the Congo above the falls, has been secured by the agents of the Belgian International Association. M. de Brazza has therefore hoisted the French flag at Loango and Punta Negra, south of Kuilu. From these points to Brazzaville on the Upper Congo, whither Dr. Ballay has been

sent in advance, *via* the Ogowé, is about 280 miles in a straight line.

Mr. O'Neill, who is about to start for Lake Shirwa, writes that from information received he begins to doubt if the Lujenda has its source in that lake. Many native traders say that it rises in a lake called Amaramba or Muaremba, and one who traveled from one lake to the other, states that there is no connection between them.

The French company entitled " Les Factoreries Françaises du Golfe Persique et de l'Afrique Orientale " has obtained considerble rights from Menelek II, King of Shoa, who rules over Obock. The company contracts to convey to Obock, at its own expense and risk and in its caravans, at fixed prices, whatever goods the king requires, also to convey the money. A mining engineer has been sent to the king, at his request, to explore the mines of copper, gold, silver, precious stones and coal which exist in Shoa. The object of the company is the development of French commerce with the east, and it has already established relations with the districts of Persia on the Tigris and Euphrates. Obock is at the exit of the Red sea and a few hours' journey from Aden. M. Soleillet reports that in his journey to Shoa, Kaffa, etc., he found that the coffee-plant forms the underwood of the forests from the River Gueba.

AMERICA.—Lieut. Bove states that Staten island, the easternmost of the Fuegian archipelago, has a deeply indented shore, is mountainous, its peaks rising to 850 meters, and displays abundant evidences of glacial action in moraines and lakes. Santa Cruz, on the eastern coast of Patagonia, is described as the best center for the population of the region, as it has a tolerable anchorage, water and wood ; yet the sand-bars in its river channel are continually shifting, from the strong currents ; and the spring tides, which rise sixteen meters, produce a violent bore.

The Chilian province of Arauco has a coast range, the Nahuelbuta, between the littoral region and the Cordillera. The rocks of the Nahuelbuta, which reaches a height of 5000 feet, are granite and crystalline schists, broken by basalt eruptions. The auriferous gravels of the streams of this region are to some extent worked and gave a rich yield to the Spaniards in the early days of their conquests—conquests which were, however, stayed in their southward progress by the brave Araucanians, who still possess a considerable proportion of good land in the south. The littoral region, some twenty miles wide, consists of Jurassic and later conglomerates and sandstones, with coal beds three to nine feet thick, and rises occasionally to 1000 feet. J. Sieveking, who contributes this information, believes the coal to be Jurassic. The coast range and littoral slope are heavily wooded, the streams short and unnavigable, the climate rough and wet, and the har-

bors open to the north-west, but closed to the south-west by sand bars built by the northward current. The Cordillera in this region is almost unknown.

Henri Froidevaux, summarizing the investigations of the rivers of Guiana, states, in agreement with Crevaux, that the abundance of village sites and relics on the banks shows there was formerly a much more abundant population.

NORDENSKIOLD'S JOURNEY OF TWO HUNDRED MILES INTO THE INTERIOR OF GREENLAND.—According to the newspaper press, advices dated Copenhagen, Sept. 21, from Professor Nordenskiöld's expedition to Greenland, have been received *via* Thurso, Scotland. They state that the expedition started from Antleiksivick on the 4th of September, and reached a distance of 360 kilometers inland, attaining a height of 7000 feet above the level of the sea. This is the first time human beings have penetrated so far into Greenland. The whole region is an ice desert, proving that there is no open water inland. Very valuable scientific data have been obtained. Along the north-west coast a cold stream flows, which induces a very low temperature, but on the eastern shore the weather is not so severe, and that coast is accessible to steamers in autumn. The expedition will return *via* Reikiavik.

When the party were 140 kilometers east of the glacier's border, the soft snow prevented their proceeding on sledges. Laplanders were therefore sent on with snow shoes. The rest of the expedition visited the north-west coast between Waigattel and Cape York. They were informed by the Esquimaux that two members of an American Polar expedition had died, and the rest had returned to Littleton island. On the 16th of August the expedition sailed south from Egedesmire, making a short stay at Ivighil and Frederiksdal, and tried to proceed eastward three times through the sound north of Cape Farewell, and once along the coast, but the ice hindered them. They went outside the ice-field to latitude 66°, remaining constantly in sight of land, having twice vainly tried to find the shore free from ice more to the southward. A band of drift ice was forced south of Cape Dan, and on September 9 they anchored in a fiord, where the remains of the Norseman period were found. This was the first time since the fifteenth century that a vessel has succeeded in anchoring on the east coast of Greenland south of the Polar circle. After having tried vainly to anchor in another fiord, more to the north, they returned, and arrived at Reikiavik on September 9th.

GEOGRAPHICAL NOTES. — The celebrated Swedish explorer, Capt. T. G. Een, died suddenly, from heart disease, at Vivi, on the Congo, when on his way to join Mr. Stanley.——The steamer *Obe* left Gothenburg, July 3d, to explore and trade upon the Siberian rivers. The *Nordenskiöld* accompanies her. Capt. Gronbeck and two Samoiedes will be left upon Novaya Zemlya to study the ice

and make meteorological observations.——Lieut. Schwatka is making a thorough exploration of the courses of the Chilkat, Lewis and Yukon.——In the *Izvestia* M. Karzin, an official of the Verkhoyansk district, struck with the terrible fate of De Long, publishes a list of all settlements and places where human beings can be met with at different seasons on the coast of Northeast Siberia.——The Indian population of British North America is, by a recently issued report, estimated at about 110,000. It is supposed that the total native population of America, north of the United States, is about 146,000, of which some 25,000 are Innuit and Aleuts. —— The planting of *Pinus pinaster* in the Landes of Southwestern France has effected a great improvement of this district. The Grande Lande, formerly a marsh in winter and a sandy desert in summer, consisting of loose soil on an impermeable hardpan (*alios*) of sandstone cemented by organic and ferruginous material, is now a forest, the resin from which is a valuable product. The dunes which stretch along the coast from the Adour to the Gironde, forming a belt four to eight kilometers wide, and stated by M. E. Blanc to come from a submerged continuation of the Landes, are now entirely wooded over. Some of these dunes reach a height of 250 feet. South of the dunes is the Marensin, which has long been a resin-producing district, and it is thought to have had harbors in Roman times, but the sands have long ago obliterated them. Still farther south along the coast is the Maremme, a region of large irregularly shaped dunes probably much older than those farther north, and occupied by an old forest of cork-oaks and resin pines.——Professor Giglioli embarked at Naples on July 25th, in the Italian man-of-war *Washington*, to resume his deep-sea and thalassographic observations in the Mediterranean.——On account of the frequent deaths of Europeans on the International Society's establishment on the Congo, a succession of new appointments have been made. These include two Swedish gentlemen, MM. Westmar and Sunvallson, and two English geographers, Sir F. Goldsmid and M. E. Delmar Morgan.

GEOLOGY AND PALÆONTOLOGY.

A NEW CHONDROSTEAN FROM THE EOCENE.—The Green River shales have produced hitherto eighteen species of fishes, one of which is a sting ray and the others Actinopteri. I now add a Chondrostean fish, which is the first one of the group described from our Eocene formations. The specimen representing the species lacks the head and pectoral fins. There are no traces of vertebræ, and there are well developed basilar interneurals and interhæmals.

Crassopholis, gen. nov.—Scales numerous, in oblique series, not in contact; formed of a small grooved disk and several posterior spines. Dorsal and anal fins short, posterior; the former com-

mencing in advance of the latter. Caudal fulcra continued into broad flat scuta extending forwards on the median line. Superior lobe of caudal fin much more produced than inferior. A lateral line.

Crassopholis magnicaudatus, sp. nov.—Basilar interneural bones 18; body slender at dorsal fin and contracted at caudal peduncle. Dorsal and anal fins moderate, caudal very large, with strong anterior fulcral rays. The fulcral scuta are longitudinally oval, and have a groove along the middle line. The caudal hæmapophyses are short and expand distally. They soon disappear in the superior lobe or axis of the caudal fin. I count nine to the anterior more or less cylindric ones. The scales are subquadrate in form and measure about a millimeter each way, including the spines, Length from notch of caudal fin to line of anterior base of dorsal, M. .170; depth at anterior base of anal, .060; depth of caudal peduncle, .035; length of inferior lobe of caudal, .110.

This discovery introduces the ancient order of Chondrostei to our Eocene fauna. The specimen was found by Mr. E. W. Holland.

I add that gars of the genus Clastes are found in the Green River shales. They are of two species, one with an obtuse muzzle like that of a Polypterus, and the other of the longer nosed type like the *C. cuneatus*.—*E. D. Cope.*

THE CARSON FOOTPRINTS.—The first definite information we received on this subject was contained in a paper by Dr. Harkness, of San Francisco, and the NATURALIST published an abstract of his article. Soon after this we received a paper on the same subject from Professor LeConte, which did not differ materially from the one which preceded it. The evidence furnished by these gentlemen indicated that the tracks were made by some anthropoid animal. Not having myself seen the tracks, I could only use the evidence available. It is now stated by Professor Marsh that there exist impressions of small anterior feet which these gentlemen have not described. If this be so, the anthropoid theory is untenable. Professor Marsh thinks they are made by sloths. To prove this hypothesis it is necessary to account for the absence of claws. The facts that gravigrade sloths walked on the side of the foot does not preclude the taking of impressions of claws. It is said, however, that the tracks, as preserved, are not the real tracks, but only rather impressions of the tracks separated by several layers of mud.—*E. D. Cope.*

THE QUATERNARY BEDS AT BILLANCOURT, PARIS.—M. E. Riviére contributes to the *Revue Scientifique* an account of the fossils found in the sand-pits of Billancourt, near Paris. *Elephas primigenius*, *Rhinoceros tichorhinus*, the Irish elk, the reindeer, *Bos primigenius*, some bones of birds and a few sponges and

shells occur along with human bones, and the bed is stated to correspond with the diluvium of the low levels at Grenelle and Levallois-Perret, and therefore to belong to the fourth of the six phases into which M. A. Gaudry divides the history of the Quaternary epoch in the Paris basin. These six phases are:

1. A hot phase, with *Elephas meridionalis*, transitional between Tertiary and Quaternary.
2. A grand glacial phase, with troops of reindeer and *Rhinoceros tichorhinus.*
3. A second hot phase, with the hippopotamus, deer, *Rhinoceros merkii* and *Elephas antiquus.*
4. A temperate phase, with a mixture of the species of hot and cold climates, including *Elephas primigenius*, *Rhinoceros tichorhinus* and the reindeer.
5. A second short cold period, the reindeer age, in which the rhinoceros has disappeared.
6. The present climate, to which belongs the age of polished stone (Neolithic).

THE JAVA UPHEAVAL.—"London, Aug. 29, 1883. A dispatch from Batavia, Java, to the Lloyds, says that the towns of Anjer, Tjiringin and Telokbelong have been destroyed by the volcanic eruptions. It also says that all the lighthouses in the Sunda straits have disappeared, and that where the mountain of Kramatan formerly stood the sea now flows. The aspect of the Sunda straits is much changed, and navigation is dangerous. The tidal wave completely destroyed Anjer. Many persons there were killed. The loss of life among both Europeans and natives at North Bantam was enormous. Since noon yesterday everything has been quiet. The sky is clear, and communication with Serang has been restored. The temperature fell 10° on Monday, but it is now at its normal height. The town is covered with a thin layer of ashes, which was so hot when falling that it killed birds. Telegraph linemen report that while they were at work repairing a line near Anjer, early Monday morning, they saw a high column of the sea approaching with a roaring noise. They fled immediately without learning the fate of the inhabitants. The quarries at Merak have disappeared, and all the people of the place perished."

The above dispatch is the first account received of one of the most disastrous volcanic upheavals on record, and following soon after the dreadful earthquake at Ischia, though of course in no way connected with it. A writer in *Nature* characterizes it as "the greatest phenomenon in physical geography which has occurred during at least the historical period, in the same space of time. From the daily newspaper press and an article in *Nature* we have made up the following account:

The center of disturbance is the volcano of Krakatoa, a little

island some six miles long and four or five miles broad, situated in the straits of Sunda, between Java and Sumatra. On Sunday evening this volcano burst into a terrific eruption. The flashes from the subterranean fires were seen at Batavia, some eighty miles east of Krakatoa. The ashes from the volcano fell at Cheribon, a town 125 miles east-south-east of Batavia, and about 250 miles eastward on the north coast of Java, from the outburst, while the detonations were heard at Sœrakarta, in the central district of Java, a distance of over 300 miles. The town of Anjer suffered apparently not only from the volcanic disturbance but from a great tidal wave which swept through the straits of Sunda. Anjer is, perhaps we ought to say was, a little seaport on the Java side of the straits about twenty-five miles east of Krakatoa island. This island, estimated to contain 8,000,000,000 cubic yards of material, seems to have been shattered and sunk beneath the waters, while sixteen volcanic craters have appeared above the sea between the site of that island and Sibisi island, where the sea is comparatively shallow. The Sœngepan volcano has split into five, and it is stated that an extensive plain of "volcanic stone" has been formed in the sea near Lampong, Sumatra, probably at a part of the coast dotted with small islands. A vessel near the site of the eruption had its deck covered with ashes eighteen inches deep, and passed masses of pumice stone seven feet in depth.

Tjiringin, another place reported as destroyed, is also a coast town on the southern shore of the straits, some thirty miles south-west of Bantam, and perhaps fifteen miles east of Krakatoa. Telokbelong, a third town mentioned as in ruins, is not in Java at all. It is a coast town of Sumatra, in the Lawpong district, on the north side of the Straits of Sunda. The loss of life is estimated at 100,000. The Island of Onrust, where the floating dock has gone adrift with serious damage, is a little island off the north coast of Java, near the City of Batavia, and contains a large government yard for the building and repair of vessels. The localities named in the dispatch show that the tidal wave passed from the Island of Krakatoa eastward through the Straits of Sunda, sweeping both shores of that passage and reached the coast of Java on the morning of the 27th, and, thirty meters high, swept the coast between Merak and Tjiringen, totally destroying Anjer, Merak and Tjiringin.

Five miles of the coast of Sumatra seem to have been swept by the wave, and many lives lost. At Tanjong Priok, fifty-eight miles distant from Krakatoa, a sea seven feet and a half higher than the ordinary level suddenly rushed in and overwhelmed the place. Immediately afterwards it as suddenly sank ten feet and a half below the high water mark, the effect being most destructive. We shall probably hear more of this wave, as doubtless it was a branch of it which made its way across the Pacific, and that with

such rapidity that on the 27th it reached San Francisco harbor, and continued to come in at intervals of twenty minutes, rising to a height of one foot for several days.

Farther advices from Colombo, Ceylon, dated London, Sept. 26, state that the recent earthquake at Java caused a sudden subsidence of the sea at Colombo of fifteen feet. On the 27th of August the water rose and fell violently for half an hour, when it resumed its normal condition. Several vessels broke from their moorings, but no other damage was reported.

Discovery of Palæozoic rocks in Western Brazil.—The region about Cuyubá is generally low, with little hills and ridges, all formed of talcose and ferruginous schists, or of heavy quartz veins. The schists strike nearly north-east, dipping north-west at a high angle. The quartz is, in parts, very auriferous, and in their time the mines of Cuyubá have been among the richest in the world.

Twenty miles north-west of Cuyubá the land rises suddenly about 2000 feet, this is the *Chapadao* or table-land; it is not, as the name might imply, a *flat* elevated plain; the surface is rolling, or even hilly and mountainous in parts, and the streams run through deep valleys or cañons. This table-land, so far as I have seen it, is composed of soft sandstones and clays of various ages, overlying the schists and appearing at the edge of the plateau in long precipices, often several hundred feet high.

The village of Chapada is on the highest part of the *Chapadao* near its southern edge, and about thirty-five miles from Cuyubá. Half a mile west of this place, on an open hillside, I found a ferruginous sandstone with casts of Spiriferæ, Terebratulæ, Tropidoleptí (?) and other brachiopods, with many Discinæ and Lingulæ; the latter were also found in a kind of iron-stone above the sandstone layer, and in soft shales below it. I found the same fossils at Laranjal, ten miles north-east of Chapoda, and at other points. The Discina appears to me to be the *D. lodensis*, found in the Hamilton group of New York State, and at Ereré, on the Lower Amazons; one of the Spirifers also resembles an Ereré species. These, with the Tropidoleptus, would, if my determinations prove correct, indicate a Lower Devonian horizon for the Chapoda beds; it is quite possible, however, that I may be wrong, as I have no books of reference on palæontology at hand, and I do not pretend to proficiency in that science. At all events the rocks described are Palæozoic, and in all probability either Devonian or Carboniferous.

My section through the Chapoda beds show nearly 500 feet of soft sandstones below them, the bottom of the series being a coarse conglomerate which rests on the schists described above. The fossiliferous beds themselves occupy from 100 to 200 feet (not yet well determined), and they are followed by nearly a thousand feet of soft sandstones, capped by 350 feet of conglom-

erate—in all over 2000 feet. The strike of the whole series is E. W., the dip being a slight one towards the north. The richest gold washings of the Chapodão are along streams which run over the sandstone and conglomerates *above* the fossil beds.—*Herbert H. Smith.*

GEOLOGICAL NOTES.—*Silurian.*—M. Lebesconte, on the occasion of the presentation to the French Geological Society of the posthumous works of Marie Roualt, gave the following reasons why Cruziana and Rysophycus, described by that geologist, should be considered to be vegetables and not the tracks of animals, as they were considered by M. Nathorst: (1) They are met with not only upon the lower surface of the beds but also upon the upper; (2) they occur even in the interior of the rock; (3) the great majority anastomose in a most intimate manner, showing plainly the points of junction, while the animal tracks that simulate vegetable forms are broken at the point of junction.

Devonian.—M. Oehlert has described in the Bulletin of the French Geological Society eight new crinoids from the department of Mayenne, including three Rhodocrinidæ, two species of Melocrinus, a Phimocrinus, a Lecanocrinus and a Hexacrinus.

Carboniferous.—M. Zeiller (Bull. Soc. Geol. France, May, 1883) gives the result of an examination of the coal beds of Tong-king. The flora of these beds differs somewhat from that of the coal beds of Europe, the greater part of Asia with China, and North America, and seems intermediate between that of these continents and that of Australia. The flora of the lower marine Carboniferous beds of Australia is similar to that of Europe, Asia and North America, and the coal beds of New South Wales must therefore be of Carboniferous age, to which also those of Tong-king belong.

Triassic.—M. Sauvage enumerates the fishes of the Muschelkalk of Lorraine, fourteen species in all.

Jurassic.—In a recent issue of the Bull. Soc. Geol. of France, M. Hebert discusses the beds containing *Terebratula janitor*, beds which he places in the Upper Jurassic, but with which M. Torcapel commences the Neocomian, and M. Parandier contributes a note upon the closed basins of the Jura mountains. These basins result from the crossing, in many directions, of dislocations of varying intensities. When the level of the interior of the closed basin is higher than that of the waters circulating outside of it, the rain water escapes by the fissures and tunnels, and penetrating through the fractures, makes its appearance outside the closed basin. This is the case with the basins of Saone and of Oroc, near Besançon, and with many others. When, on the contrary, the level of the bottom of the closed basin is below that of the waters exterior to it, these exterior waters penetrate into it along one of the lines of rupture, enlarging the fissure by their erosion.

In this manner the Donbs traverses the basin of Morteau, receiving a rivulet from its interior as it passes.——M. Cotteau also contributes a note upon the Jurassic echinids of Algeria, forty-seven in number. One only of these species is found in the Oxford stage; thirty-seven to the upper coralline, and seven seem to be Kimmeridgian. Nineteen are new and known only in Algeria, while the remainder occur in Europe, usually at the same stratigraphic levels.

Tertiary.—The cerebral hemispheres of *Arctocyon dueilii* and *Pleuraspidotherium aumonieri*, discovered by M. Lemoine in the Eocene of the environs of Rheims, are stated by that geologist to be so reduced in dimensions as to be scarcely superior in transverse diameter to the olfactory or the optic lobes, the latter of which are entirely uncovered.——M. Hebert (Bull. de la Soc. Geol. de la France, 1882) has described in detail the nummulitic group of the south of France. This group belongs to the Middle and Upper Eocene, and occurs in the Central Pyrenees, at Chalosse, at Corbières and Montagne Noire, and in the environs of Nice.

General.—Mr. G. K. Gilbert states that the great fault along the western base of the Wasatch mountains is wanting opposite Salt Lake City. He suspects that the fault will yet be completed at that point, and that when the slip occurs it will cause an earthquake which will destroy Salt Lake City.

MINERALOGY.[1]

Experimental Studies upon Rocks.—M. J. Thoulet,[2] after deploring the absence of general results arrived at by lithologists, has proposed to himself the study of all the physical properties of the same rock in order that, by a comparison of the data thus obtained, any relations which exist between these diverse properties may be discovered, and at all events the physical constants of the rock may be systematically stated. He holds that lithology should be systematized by the common application of both the physical and natural sciences to the study of the genesis of rocks, and shows the necessity of obtaining, in the first place, exact figures upon which to found satisfactory conclusions.

He gives the physical properties of a basalt and of a compact limestone, enumerating succinctly the locality, the macroscopic and microscopic appearance, specific gravity, chemical composition, *hygrometricity* or amount of moisture ordinarily contained, *imbibition*, or faculty of absorbing water, thermic conductibility, specific heat and resilient elasticity or power of rebounding.

This method of proceeding, although laborious, is believed to be alone capable of furnishing certain results.

[1] Edited by Professor H. Carvill Lewis, Academy of Natural Sciences, Philadelphia, to whom communications, papers for review, etc., should be sent.

[2] Bull. Soc. Mineralogique de France, T. vi, No. 6, p. 161.

The *hygrometricity*, or amount of moisture absorbed from the air, is obtained by heating the rock at 100° C. until the weight is constant, and reducing the result to decimals. In expressing the hygrometricity of basalt as 0.371, it is meant that 100 grammes of the dry rock weigh 100.371 after the expulsion of the humid air. The hygrometricity of limestone is 1.669.

The *imbibition*, or faculty of absorbing water, is measured by soaking the rock in water for some time under the bell glass of an air pump, and then weighing after it has been carefully wiped. It represents the maximum of water absorbed by 100 grammes of rock perfectly dried at 100° C. The imbibition of basalt is 0.551, of limestone 1.981.

The thermic resistance and coefficient of thermic conductibility is obtatined by determining the time, in seconds, which it takes for an interval of temperature of 34° C., issuing from a fixed source of heat at 100° C. to traverse the thickness of one centimeter of rock. The temperature of the rock at the beginning and end of the experiment is noted, as well as its weight, amount of surface, thickness, etc., much care being required for this determination. The thermic resistance is obtained graphically from these data. For basalt it is given as 83, and for limestone as 59.

The specific heat is obtained by a method previously described by Lagarde and the author, and involves the immersion of the rock in alcohol whose volume, density and specific heat are previously known. Thomson's galvanometer is used in the experiments, and the specific heat of basalt is determined as 0.2699, and of limestone as 0.253.

The elasticity of rebounding, which is directly related to the molecular elasticity developed by either optical, thermic or mechanical vibrations, is determined very simply, by counting the number of times that a ball of ivory rebounds from the rock. While quartz causes the ball to rebound 42.2 times, basalt causes it to rebound 25.9 times, and limestone 35.48 times. Taking the elasticity of quartz as the unit, the resilient elasticity of basalt is 0.614, and of limestone 0.840.

STIBNITE FROM JAPAN.—The very beautiful crystals and groups of crystals of stibnite from Japan, are already well known to a number of mineralogists. The specimens, by their beauty, brilliancy and size, will attract attention in any cabinet. They are said to come from the Island of Jaegimeken Kannaizu, in South Japan, where the antimony mines have long been worked. The crystallized specimens are valued as ornaments by the natives, who sometimes mount them in flower pots and use them to adorn their dwellings.

In a recent paper in the *American Journal of Science*, by Professor E. S. Dana, describing some remarkably fine specimens recently received by the museum at Yale College, it is shown

that the crystals are noteworthy, not only on account of their size and beauty, but also for their great complexity of form.

Some crystals measured nearly two feet in length and two inches in diameter. They occur in groups, which consist of diverging crystals, many of which may be over a foot in length. The prismatic planes are deeply striated, and the end of each crystal is finely terminated by brilliantly polished planes. The luster of these planes is unexcelled among metallic minerals, and can be compared only with that of polished steel, as, for example, the surface of a razor blade.

Professor E. S. Dana has observed as many as *eighty-five* planes on these Japanese crystals. Forty-five planes was the largest number previously observed on stibnite, so that forty new planes are thus added. Some of the most complex crystals are the smallest ones. Sometimes, even on large crystals, the minute terminal planes are so rounded into each other that they could not be measured. Often these steep pyramidal planes so sharpen the end of the crystal as to give it a spear-shaped appearance.

A common peculiarity of the Japanese crystals, as indeed of all stibnite, is a bending over in the direction of the macrodiagonal axis. The edge of the crystal, near its termination, may be bent so as to form a right angle with itself. Crystals of stibnite from other localities have been described which were bent to such a degree as to form a complete ring. This curious peculiarity appears in all cases as if produced subsequently to the formation of the crystal. It has been shown that a slight pressure will permanently distort a crystal of stibnite.

The axial ratio as deduced from the measured angles is found to be :

$$a : b : c = 1 : 1.00749 : 1.02550$$

In order to preserve the brilliant luster of these crystals, we suggest that mineralogists keep them in a dark place, well protected from dust and dampness.

A Beautiful Crystal of Apatite.—A. Schmidt, of Strasburg, describes and figures in the last number of *Zeitschrift für Kryst.* (VII Band, 6 Heft), a remarkably beautiful crystal of colorless apatite from Floitenthale, a new locality. The specimen, which measures only about 1.5 centimeters in length, and which resembles a garnet in general shape, being nearly equi-axed, for geometrical beauty of shape and complex but symmetrical proportions can hardly be excelled, unless indeed the figure given greatly idealizes it. The specimen belongs to the Hungarian National Museum.

Precious Iolite from Brazil.—In looking over a collection of Brazilian minerals, Professor Groth recently noticed a colorless

prismatic mineral labeled topaz, which attracted his attention from the fact that it showed no trace of cleavage on the broken end, but had an irregular, conchoidal fracture. A trial of the specific gravity gave 2.67, too low for topaz, and it was concluded that the crystal was iolite (cordierite). The crystal was 1.5 centimeters long and 1 centimeter broad, larger than ever before known in Brazilian crystals. The absence of color in such a large crystal indicates that the usual deep bluish color is accidental and due to some coloring pigment.

SEPARATION OF MINERALS ACCORDING TO THE DEGREE OF COHESION.—Büttgenbach[1] has suggested the separation of minerals on a large scale by making use of the difference in their degree of brittleness or firmness. Hitherto such separation has been effected mainly by differences in specific gravity or in attractability by the magnet. The author has devised a practical method of separating ores, based upon the fact that by casting two minerals of different degrees of hardness against a solid body, the one is broken into smaller pieces than the other. In separating pyrites from zinc blende the mixture was cast three times against the sides of a cylinder, and then sifted through separating drums, when it was found that the particles which passed through the finer sieves consisted chiefly of blende, while the larger pieces left behind were pyrites.

LITHIOPHILITE.—Mr. S. L. Penfield[2] has published two new analyses of lithiophilite, which are of interest in that they substantiate the formula of an orthophosphate, Li (Mn, Fe) PO_4, for the species, and taken together with his previously published analyses, complete a series showing a gradual transition between the two extremes of a lithia-iron phosphate containing little manganese (triphylite) and a lithia-manganese phosphate containing but little iron (lithiophilite). Lithiophilite is, therefore, a manganesian variety of triphylite.

One of the analyses was made on a pale bluish, transparent, brilliant lithiophilite from Branchville, Conn., and the other upon specimens from Norway, Maine, a new locality. The specimens from the latter place are blackened on the exterior by the oxidation to which this mineral is particularly liable, but in the interior are of a light salmon color.

SOME RECENTLY FORMED MINERALS.—A. Lacroix has artificially produced crystals of gypsum by treating pulverized fluorite with sulphuric acid and then adding water. After standing for several months at a low temperature until the liquid had evaporated, small but beautiful transparent crystals of gypsum were found upon the fluorite and on the sides of the containing flask.

[1] *Dingl. Polytech. Journ.*, 248, 112.
[2] *Amer. Journ. Sc.*, Sept., 1883.

In crystalline form as well as in the mode of grouping, the crystals closely resemble some small crystals of gypsum which occur at the salt works of Bex, Canton of Vaux. These may also be of recent origin.

The same author has described some interesting minerals which have formed upon some old Roman coins of the time of the Emperor Alexander Severus (205–234 A. D.), which were buried in a mass of rubbish in Algeria. The coins contain eighty per cent of copper, sixteen per cent of lead and four per cent of tin, and through the action of dampness have become oxidized so as to form malachite, azurite, cuprite and cerussite. The coins were cemented by cavernous malachite, in the interstices of which were crystals of the above minerals. The cuprite occurred in cubes of cochineal-red color, and the azurite in clear blue crystalline masses. The cerussite, the most interesting mineral noticed, occurred both in crystals and in crystalline masses of yellowish-white color and adamantine luster. The crystals of this mineral, never before noticed under similar conditions, sometimes were directly implanted upon the partially altered coins.

PYRITES FOR SULPHURIC ACID.—It is now stated that sulphuric acid can be made as cheaply from American pyrites as from imported brimstone, and considering the great difference in freight between the two raw minerals, the price of acid made from our pyrites will be much lowered. Immense deposits of pyrites occur in Virginia, and these will undoubtedly be used in large quantities for the manufacture of sulphuric acid. Should the manufacturers of our sea-board cities use pyrites instead of sulphur for this purpose, it is stated that commercial acid (66° B.) can be made by them at one cent per pound. A most important industry of great value to the country can thus be opened, and many mines of pyrites will be opened to add to the mineral wealth of the Eastern States.

PICRANALCIME.—Some years ago Bechi described a mineral from Monte Caporciano, Tuscany, under the name of *picranalcime*. It was stated to be an analcime of a red color containing ten per cent of magnesia, and only a half per cent of soda, and was generally regarded by mineralogists as an alteration from analcime. Bamberger, however, has shown that ther is no magnesia in the mineral, and that in every respect, crystallographically, optically and chemically, it agrees with analcime. The name "picranalcime" must therefore be dropped from the list of minerals.

MINERALOGICAL NOTES.—To determine the mineralogical species to which the *jade* of different localities properly belongs, frequently requires a chemical analysis. Specimens of jade from New Zealand and from Southern Turkestan, the latter from a mine once worked by the Chinese, have been analyzed by C. L.

Allen and determined to be amphibole.——Klein has recently examined some crystals of *ullmannite* from Sardinia. The principal planes were those of the cube, which was striated as in pyrite, being due to the same cause, the repetition of pyritohedral edges. Pyritohedral and dodecahedral planes also occurred. The specific gravity was somewhat higher than usual, being 6.84. An analysis showed a mere trace of arsenic. The determined percentages of nickel, sulphur and antimony agree closely with the formula, Ni (Sb, S). The crystals were imbedded in calcite.—— It has been found that almost all platinum ore is magnetic, and that no purification can be effected by means of a magnet. Even a weak magnet will attract a large percentage of platinum along with the iron in an impure ore. Experiments have shown, indeed, that as much platinum as iron is attracted.——*Gold* is reported as occurring in a Cretaceous limestone in Williamson county, Texas. It is supposed to have originally existed as an auriferous pyrite, by the decomposition of which the sulphur has been removed, the iron oxidized and the gold concentrated.

BOTANY.[1]

WATSON'S CONTRIBUTIONS TO AMERICAN BOTANY, XI.—We have the pleasure of again noticing another of Mr. Watson's frequent publications, this time a thick pamphlet of one hundred pages, extracted from the Proceedings of the American Academy of Arts and Sciences (Vol. XVIII). It bears date of August 15, 1883, and contains descriptions of many new species. There is first a list of plants from Southwestern Texas and Northern Mexico, collected chiefly by Dr. E. Palmer in 1879–80, occupying nearly the whole pamphlet; this is followed by five pages devoted to descriptions of some new Western species.

The Commelinaceæ of the United States are revised in a footnote, and a synopsis of genera and species given. There is likewise a revision of the genus Bouteloua, based upon a study of the material in the Gray Herbarium. Twenty-five species are recognized, as follows: 1. *B. tenuis* Griseb., Mexico; 2. *B. prostrata* Lag., W. Texas and New Mexico to Mexico; 3. *B. simplex* Lag., South America; 4. *B. scorpioides* Lag., Mex.; 5. *B. hirsuta* Lag., Ill. to Tex., Arizona and Mex.; 6. *B. oligostachya* Torr., Saskatchewan to Tex., Ariz., S. E. Cal. and Mex.; 7. *B. polystachya* Torr., S. Utah to Tex., S. Cal. and Mex.; 8. *B. eriopoda* Torr., W. Tex. and New Mex.; 9. *B. trifida* Thurber, W. Tex., New Mex. and Mex.; 10. *B. burkei* Scribner, W. Tex. and New Mex.; 11. *B. racemosa* Lag., N. Y. and Pa. to Wis., Tex., Ariz. and Mex. [this is the *B. curtipendula* Torr., of the manuals]; 12. *B. bromoides* Lag., W. Tex. to Ariz. and Mex.; 13. *B. havardi* Vasey, W. Tex.; 14. *B. chondrosioides* Benth., Mex.; 15. *B. litigiosa* Lag., W. Indies;

[1] Edited by PROF. C. E. BESSEY, Ames, Iowa.

16. *B. elatior* Griseb., W. Indies; 17. *B. ciliata* Griseb., S. America; 18. *B. lophostachya* Griseb., S. America; 19. *B. nana* Griseb., S. America; 20. *B. pilosa* Benth., Galapagos islands; 21. *B. aristidoides* Thurber, New Mex. to S. Cal. and Mex.; 22. *B. triathera* Benth., Mex.; 23. *B. texana* Watson, Tex.; 24. *B. disticha* Benth., Peru; 25. *B. multiseta* Benth., Brazil.

A Hybrid Moss.—H. Philibert records (*Rev. Bryol.*, x) a new instance of a hybrid moss found wild, between *Orthotrichum diaphanum* and *O. sprucei*. He considers it a true instance of a hybrid sporogonium, resulting from the fertilization of an archegonium of *O. sprucei* by antherozoids of *O. diaphanum*. The hybrid was intermediate in its characters between the two parents, and also in the time of producing its reproductive organs.—*Jour. Royal. Mic. Society for August, 1883.*

Projectile Force in Æcidium.—Dr. Alexander Zalewski has recently made some interesting observations on the force with which spores of the Æcidiums are discharged. He finds that in Æcidiums growing on thick coriaceous leaves or on stems and petioles, the spores are thrown vertically 10–20$^{mm.}$

The species in which he has noted this great projectile force, are the Æcidium of *Uromyces pisi* on *Euphorbia cyparissias*, the *Æcidium* of *Puccinia straminis* on *Lycopsis arvensis* and *Æcidium symphyti* on *Symphytum officinale*, while the Æcidiums on thinner leaves, as the *Æcidium* of *Puccinia calystegia* on *Calystegia sepium* and the *Æcidium* of *P. coronata* on leaves of Rhamnus discharged their spores with a force sufficient to throw them vertically only 4–6$^{mm.}$ or at most 8$^{mm.}$ He also notes that from cups of this latter species, growing on the petioles of the leaves, the spores were thrown higher than from those on the thin lamina of the leaf.—*Inaugural dissertation delivered before the Kaiser-Wilhelms-Universitat at Strassburg, 1883.*

New Species of North American Fungi.—*Septoria xanthifolia* E. & K.—Epiphyllous, on light brown, rather indefinitely bordered and irregularly shaped spots, 1-4^{mm} diam., scattered over the leaf and giving it a scorched or withered look; perithecia rather numerous, slightly prominent, black, minute (70μ.); spores abundant, short, 20–30 × 1¼–1½μ., slightly curved and faintly nucleolate, yellowish. On leaves of *Iva xanthifolia.*

Septoria cacaliæ E. &. K.—Spots rusty brown, elongated or nearly circular, ¼–½^{cm} diam., with a distinct raised border and often including 1–2 smaller white spots (1–4^{mm}), which also have a distinct raised border of their own, these white spots also occur in the green portions of the leaf; perithecia amphigenous (on both the brown and white spots) or scattered over dead parts of the leaf, about 100μ. diam, black and slightly prominent; spores abundant, nearly straight, 30–35 × 1–1½μ., faintly nucleolate. On leaves of *Cacalia tuberosa.* Manhattan, Kansas, Aug., 1883.

Septoria helianthi E. & K.—Perithecia epiphyllous, immersed, brown, collapsing 150μ. diam., on brown definitely limited spots ¼–¾^{cm} diam., with a yellowish scarcely raised border; spores linear-filiform, hyaline, nucleate, becoming 3–5 septate, 30–70 × 2–3μ., generally attenuated towards one or both ends. This is distinct from *S. helianthicola* C. & H., and from *S. paupera* Ell. On leaves of *Helianthus doronicoides.* Manhattan, Kansas, Aug., 1883.

Septoria gaurina E. & K.—Perithecia numerous, brown, immersed, 100–140μ. diam., visible on both sides of the leaf, but opening above and expelling the linear, curved, continuous or 1–3 septate, yellowish, granular 50–75 × 2½–3μ. spores in the form of white cirrhi. Spots light dirty brown with a rather irregular outline and a definite but only slightly raised border. On leaves of *Gaura parviflora.* Manhattan, Kansas.

Septoria mimuli E. & K—Spots white (1–2^{mm}) with a dark border; perithecia few (4–10), 80–100μ. diam., black, about equally conspicuous on both sides of the leaf; spores linear, continuous, faintly nucleolate, yellowish, often thickened at one end, 15–30 × 1–1¼μ. On leaves of *Mimulus ringens.*

Septoria sphærelloides E. & K.—Perithecia covered by the epidermis, 80–90μ. diam., perforated above, scattered evenly over the stem or collected on elongated blackened places, in which case they appear like a minute Diaporthe; spores nucleate, filiform, nearly straight, 15–22 × 1–1¼μ. On dead stems of *Hypericum corymbosum.*

Phyllosticta affinis E. & K.—Spots brown, lighter in the center, of irregular shape, elongated and angular, ½–1^{cm} diam., with a dark raised border; perithecia yellowish, depressed, rather large, few, subcentral; spores oblong or oblong-elliptical, 4–6 × 2. On living leaves of *Sassafras officinalis.* Quite different from *P. sassafras* Cke., which has globose brown, coarsely granular spores (?) on indefinite, dark colored spots.

Phyllosticta decidua E. & K.— Spots thin, white deciduous, 1–2^{mm} diam., subangular, often confluent and irregular, margin definite but scarcely raised; perithecia small (60–100μ.), sparingly scattered over the spots and visible on both sides of the leaf; spores oblong-elliptical, 3–7 × 1½–3μ. (mostly 3–4 × 1½μ.), the longer ones with 2–3 faint nuclei. On leaves of *Leonurus cardiaca, Nepeta cataria* and *Mentha piperita.* This appears to differ from *P. galeopsidis* Sacc, in its variable spores and deciduous spots, which give the leaf the appearance of having been eaten out by insects.

Phyllosticta asiminæ E. & K.—Spots pale brownish, of irregular shape (½–1^{cm}), bordered by a distinct dark raised line; perithecia subglobose, deeply immersed, their apices barely visible on the upper surface of the leaf, scattered, 100–120μ. diam.; spores yellowish with a slightly greenish tinge, obovate, 7–9 × 5–6μ. On leaves of *Asimina triloba.*

Phyllosticta lycii E. & K.—Perithecia depressed, 100μ. diam., black, visible on both sides of the leaf, on brown orbicular spots, 1–2^{mm} diam., at length whitening out and with a narrow distinctly raised border; spores elliptical or ovate-elliptical, 5–12 ×2–3μ. (mostly 5–7 × 2½μ.) subacute. The spots are concave on both sides of the leaf, more distinctly so above, and on account of the abruptly raised margin look like little round disks lying on the surface of the leaf. On leaves of *Lycium vulgare*.

Ramularia mimuli E. & K.—Spots suborbicular, ¼–½$^{cm.}$ with a dark shaded border which is more conspicuous above; hyphæ mostly hypophyllous, subfasciculate, continuous, subhyaline, 30–40 × 3μ.; conidia cylindrical, hyaline, uniseptate, 30–40 × 3μ. On leaves of *Mimulus ringens*. Closely allied to *R. phyteumatis* Sacc. & Winter.

Cercospora vernoniæ E. & K.—Epiphyllous on small (1–3^{mm}), round, gray or purplish-gray spots (which finally whiten out), with a distinct narrow raised border, which is surrounded by a purplish discoloration; hyphæ cæspitose, subfuscous, continuous, subnodulose and subdenticulate above, 25–40 × 4–5μ.; conidia slender clavate, 6–9 septate, 75–100 × 3–4. On leaves of *Vernonia fasciculata*. Manhattan, Kansas.

Cercospora sambucina E. & K.—On small suborbicular red-brown spots (2–3^{mm}), with a narrow raised border; hyphæ densely cæspitose, epiphyllous brown, flexuous, 100–150 × 3–4μ., continuous; conidia cylindric-clavate, curved, 3–7 septate, 55–75 × 3–4μ. On leaves of *Sambucus canadensis*.

Sphærella campanulæ E. & K.—Perithecia minute (¼^{mm}) scattered, covered by the epidermis, which is pierced by the papilliform ostiola; asci subcylindrical, 35–40 × 5–7μ.; sporidia crowded, uniseptate, constricted and oblong-ovate, ends subacute, 10–13 × 3–3½μ. On dead stems of *Campanula americana*.

All the species above described were collected by Professor W. A. Kellermann, and all not otherwise noted were collected in Fairfield county, Ohio, in July and Aug., 1883.

Corrections.—In the December number of this journal (1882), p. 1002, top line, for "114 × 3," read 114μ.; same page, eighteenth line from top, for "25–30μ.," read 35–55μ.; same page, sixteenth line from bottom, for "iolani," read Solani.—*J. B. Ellis, Newfield, N. J., and W. A. Kellerman, Manhattan, Kan.*

A Study of the Survival of the Fittest.—About three years ago a piece of ground at Kew was specially set apart to contain a collection of hardy herbaceous plants for the use of botanical teachers and their pupils. It was a perfectly level square of ground in the immediate neighborhood of the herbarium, which for a long time had been covered with grass, amongst which a few trees were planted. It was spaced out into beds with walks between them, and about 250 species were selected and a good tuft of each was planted in the beds. Each species had a

distinct plat allotted to it, the soil being quite uniform, and the species being arranged according to their systematic sequence. I have now had the collection under constant inspection for three years, and have made a catalogue of the species, classifying them in three groups, according to their power of survival under the conditions as explained. * * *

CLASS A. Species that have shown a distinct tendency to spread over the walks and take possession of the plots of ground that belong to their neighbors; fifty-nine species.

CLASS B. Species that have held their ground but do not spread; one hundred and forty-four species.

CLASS C. Species that would soon become extinct unless renewed; fifty-six species.

—*J. G. Baker, in Journal of Botany.*

[In the foregoing we have omitted the lists of names. It may be interesting to note that in Class A occur Ranunculus arvensis, Lepidium sativum, Capsella bursa-pastoris, Spergula arvensis, Lychnis githago, Œnothera biennis, Epilobium angustifolium, Fœniculum vulgare, Pastinaca sativa, Dipsacus fullonum, Chrysanthemum leucanthemum, Taraxacum officinale, Linaria vulgaris, Cynoglossum officinale, Convolvulus arvensis, Plantago major, etc., most of which are weeds. In Class B occur Ranunculus acris, Dicentra spectabilis, Linum usitatissimum, Trifolium pratense, Trifolium hybridum, Helianthus decapetalus, Solidago canadensis, Monarda fistulosa, etc., etc. In Class C we find Ranunculus bulbosus, Reseda odorata, Phlox paniculata, Cannabis sativa, Hordeum jubatum, Avena sativa, Lolium italicum, etc.—ED. BOT. NOTES.]

POPULAR BOTANY.—It is a matter of regret that the eminent men who have devoted their lives to botany in this country, have not found time to turn aside from their heavier labors now and then, for the purpose of writing books for the people—the great unbotanical majority who make up so large a part of every community. It would doubtless have taken valuable time, and no doubt some of the things now done would have been left undone, yet we are confident that it would nevertheless have been much better for the science of botany. There is a duty which every scientific man owes to the community which supports or tolerates him, a duty which becomes greater as his authority and influence are increased in his chosen field. That duty is to present in the vernacular of the people the leading facts in his science. It is impossible for all the people to become botanists, zoölogists, chemists, etc.; only a favored few are permitted to enter the temple of science, and to them the people rightly look for instruction.

In a little book before us,[1] we have a pleasant attempt by the

[1] Plant Life: Popular papers on the Phenomena of Botany. By Edward Step. New York, Henry Holt & Co.

president of the Lambeth (England) Field Club, to present in a popular way many of the more important facts in modern botany. It is not a text-book, and does not follow text-book methods. We have first a pleasant and entertaining account of microscopic plants in which Protococcus, Zygnema, Volvox, desmids, diatoms, etc., are described. With this as a basis, Chapter II presents the main facts as to plant structure and growth. Then follows an excellent chapter on the fertilization of flowers, the opening sentence of which is well worth quoting: "It is popularly held that the chief end of plants is to minister to man's sense of the beautiful in form and color, but recent investigations of scientific men should dissipate so presumptuous a theory."

Predatory plants, ferns, mosses and lichens, horsetails, fungi, etc., are taken up in various chapters, while less botanical subjects, such as the folk-lore of plants, planets and animals, plants and planets are intermingled. The chapter on the folk-lore of plants contains much that is interesting. A paragraph here may serve to show the author's method: "Who was the miscreant that altered the popular orthography of *Digitalis purpurea* from folk's-glove to foxglove? With that alteration all the poetry and the associations of fairyland were taken from the name. True, it is still the noblest of our native flowers, and one that will ever be a favorite with all; but it was the flower which supplied the fairies with gloves—delicately tinted silken coverings fit for the hands of such dainty folk—hence folk's-glove."

The little book is well work reading by even those who are versed in botany. Such will find little or nothing that is really new, but we venture to say that no one will read it without feeling repaid for the time so spent.

Botanical Notes.—In a paper read at the Minneapolis meeting of the American Association for the Advancement of Science, Dr. J. W. Dawson described two Palæozoic species of what appear to be Rhizocarps allied to Salvinia. They are named provisionally *Sporangites braziliensis* and *S. bilobata*, but "in prospect of the discovery of their vegetative parts," the name Protosalvinia is suggested for them.——In the August *Journal of Botany* Greenwood Pim describes a mould evidently related to Eurotium (Aspergillus) or Penicillium. He proposes the new genus Alliospora, and names the species *A. sapucayæ*. The specimen was found as a velvety brown-black growth on decaying Sapucaya nuts.——W. B. Grove describes, in the September number of the same journal, "A new Puccinia," which occurs on various species of cultivated violets in England. From the description given it appears to differ very little from *Puccinia violarum* as it occurs in this country. The supposed new species is named *P. ægra*.——In the same number H. F. Hance describes a new genus of Liliaceæ under the name of Disporopsis. It has affinities with the genus Polygonatum. One species (*D. fusco-picta*) from the province of Canton, China,

is described.——Dufour has described a fungus which grows on sponges, disintegrating the skeleton, and rendering it worthless. He names it *Torula spongicola*.——Most collectors have had to do with the yellow filamentous growth named Ozonium, but hitherto scarcely assignable to any place in a botanical system. Roumeguère concludes, from his recent investigations, that it is a sort of sclerotium stage of various hymenomycetous fungi belonging to the genera Coprinus, Lenzites and Craterellus.

ENTOMOLOGY.[1]

ENTOMOLOGY AT MINNEAPOLIS.[2]—*Remarks on Arzama obliquata.*—Mr. Riley also gave his experience in rearing this insect during the past two years. He exhibited specimens in all states. The eggs are laid in curious, broadly conical or plano-convex masses enveloped in hair and a mucous cream-colored secretion, which, combined, look much like spun silk inside and the glazed exudation of *Orgyia leucostigma* outside. The larva, pale at first, and more or less transparent during the earlier stages, but dark after the later stages, bores into the stems of Sagittaria and Pontederia and is semi-aquatic, the last pair of spiracles being exceptionally large and dorsal. There are two annual broods, the second hibernating as larva in moss and decaying stumps near the water. The moth shows great variation in color, and the summer generation is, on the average, not much more than half so large as the spring or hibernated generation and generally much paler. He had interesting notes on this and other semi-aquatic species, and would shortly publish a more full account of them.

Dr. Kellicott said he had bred this moth at Buffalo, N. Y., where it was very abundant, and he had found it to be single brooded. It is associated with another species, an account of which he promised to give at a future session. Adjourned.

August 15, 2 P. M., the club reconvened. Professor S. A. Forbes presented a paper entitled, "Memoranda with regard to the contagious diseases of caterpillars and the possibility of using the virus of the same for economic purposes." The following is a full abstract:

The use of contagious germs as insecticides.—Pasteur made, in 1869, discoveries showing that a contagious disease of the silkworm, one of the two to which the rapid decay of the silk industry at that time was due, and known to the French under the name of *la flacherie*, and to the Germans as *schlaffsucht*, was caused by the presence of ferment germs in the intestines of the worms, and afterward in the blood. He stated that Pasteur proved, by means of careful experiment, that this disease could be easily induced in healthy worms by sprinkling their food with

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

[2] Continued from p. 1070.

the dust of the excreta of diseased individuals, or an infusion of that dust; by exposing healthy worms to mere association with those suffering from *la flacherie*, and by simply moistening the food of perfectly healthy examples with an infusion of mulberry leaves which had begun to ferment. In this fermenting fluid appeared immense numbers of bacteria—evidently chiefly Micrococcus and Bacterium, as those genera are now understood—and after infection of their food the silk-worms contained these same bacteria in swarms, at first in the alimentary canal, where they set up a ferment of its contents, and later without the intestinal wall, causing a rapid decay of the tissues, accompanied by a conspicuous blackening of the skin. This invasion of the blood was usually post mortem, but sometimes occurred before life was extinct.

Professor Forbes detailed that in July, 1882, he found that the chinch bug was subject to a bacterian parasite belonging to the genus Micrococcus, which was, as a rule, abundant in the bugs infesting a certain field of corn, but could be rarely demonstrated in any number in specimens from fields not far removed. He found by careful dissection and observation that this Micrococcus has its principal, perhaps exclusive, seat in the alimentary canal; that the chinch bugs were becoming continually less numerous in the field where they were most attacked by it; that the apparent mortality affected chiefly the older individuals, as shown by the much smaller ratio of adults when compared with the brood elsewhere at this period; that the numbers of the Micrococcus increased rapidly when the bugs were closely confined without food, the bodies of starved specimens being alive with them; and that the same Bacterium occurred in myriads upon the surface of cornstalks which had been punctured by the bugs, evidently multiplied freely in the fermenting process of the plant. He also found that it could be readily cultivated in both animal and vegetable infusions infected from the fluids of the bugs; that it retained its vitality in a dried condition for several months, and that it multiplied rapidly in the blood of caterpillars when introduced by puncture with a fine needle, causing a torpid and helpless condition. He had, further, lately observed among caterpillars of *Datana ministra* a fatal, and seemingly contagious, disease extremely similar to *schlaffsucht*, and characterized, like that, by the excessive development of a Micrococcus in the intestines and in the blood,—in both before death. He had cultivated this Micrococcus without difficulty in both animal and vegetable infusions, and had begun experiments to determine whether the disease could be conveyed to healthy caterpillars by the use of these infected infusions.

Mr. Riley referred briefly to the similar endeavors by Europeans to utilize these disease germs against injurious insects, and regarded Professor Forbes's experiments of great scientific importance, but doubted whether, for many reasons, the results would prove of practical value to the farmer.

Bombus pennsylvanicus in a deserted wren's nest.—Professor Osborn called attention to the fact that he had noticed this species inhabiting a deserted wren's nest situated under the roof of a porch and at least twelve feet from the ground, it being the first instance he was aware of where they nested away from the surface of the ground.

Professor Westcott thought Xylocopa might have been mistaken for Bombus. Mr. Riley saw no reason to doubt the facts mentioned by Professor Osborn or that Xylocopa with such different appearance and habits could be mistaken for the Bombus, which was well known to utilize mouse nests.

Dr. Kellicott had noticed the occurrence of the same or some allied species of Bombus inhabiting a mouse's nest in the brace of a barn. Miss Murtfeldt had seen them domesticated in a marten's nest.

Plusiodonta compressipalpis.—Dr. Hoy presented for inspection the larvæ, pupæ and imagines of *Plusiodonta compressipalpis.* He had watched this moth through its transformations, and had noted that during its early larval stages its prevailing color was a pea green varied with uniformly-placed black spots, which increased in number with each successive molt. Only during the last stage of its larval life was the insect usually noticeable by other than professional eyes, since then its color was reddish-brown ornamented with cream white. *Menispermum canadense* was its food-plant. The cocoon was formed by first building two nearly parallel, elliptical walls and then uniting them at the top. Some larvæ which had been displaced after beginning to pupate, had apparently become exhausted, or their teeth loosened, anticipatory of their approaching new condition, and they were willing to accept bits of paper held to them on a pin, with which they finished the cocoons already begun. The species in Racine cannot be more than two-brooded. The larvæ are not distinguishable from those of Geometrid moths, as they are true loopers. Their transformations in some particulars were exceedingly prompt, occupying only 30 days from the time the eggs were laid.

Dr. Riley stated that he had known certain Lepidoptera and notably *Leucania unipuncta, Aletia xylina* and *Anisopteryx pometaria* to go through larval growth in less than a fortnight. He had also reared *Plusiodonta compressipalpis* from *Menispermum canadense,* but was much interested in Dr. Hoy's account of the formation of the cocoon, as it undoubtedly explained the method that prevailed in all species which simulated the surroundings by covering the outside of the cocoon with particles of the object of attachment.

Professor Herrick made inquiry as to what are sometimes known as frost flies. Dr. Kellicott called attention to a monograph by T. Rymer Jones and one by E. Ray Lankester, to

be found in the *Quar. Jour. of Mic. Sci.*, and stated that the species common at Buffalo was *Corethra plumicornis.* Professor Forbes had noticed the larvæ of Corethra abundant in the stomachs of fishes. Adjourned.

Aug. 17, 2 P. M., the club reconvened and the following subjects were presented:

Food-habits of Gortyna nitela.—Professor Osborn stated that he had observed the larvæ of *Gortyna nitela* boring in young twigs of ash and had noticed many dead twigs from this cause. Had failed to rear imagos from these on account of parasites. He had also observed the same species feeding externally upon the leaves of the common plantain.

Gall-mites.—Professor Forbes stated that Mr. Garman's work on gall-mites is in press; that Mr. G. has familiarized himself with the bibliography of the subject and has made a careful study of gall-mites with a view to description of the species from physical characters rather than from the standpoint of their effects.

Black-knot.—Mr. Saunders remarked that he had noticed this year an unusual amount of the black-knot.

Aug. 16, 10 A. M., the club reconvened, when the president, Dr. Kellicott communicated the following:

Notes on certain boring Lepidopterous larvæ.—1. *Arzama obliquata* G. & R. This larva has already been referred to at a previous session of the club by Dr. Riley; some additional remarks may not be out of place. Its food-plant at Buffalo is almost entirely *Typha latifolia.* I have found it rarely in Sparganium. The eggs I have not found, but the small larvæ have been seen as early as June 12th. They feed at first in the spadix; they afterwards bore into the stems, remaining until fall, when they leave the same and crawl into the earth or old wood until April or May, when they transform in slight cocoons; the moths appear late in May. Dr. Riley has called attention to the fact that the last pair of spiracles are large and placed dorsally; this arrangement enables them to swim in the water or crawl about in the mud without suffocation. I have had them swimming in a pail of water five or six hours without apparent injury. When removed from their galleries and put in the water, they sink to the bottom and remain some time, finally rising to the top and swimming about for a fresh food-plant. I feel sure it cannot be double brooded at Buffalo. I have found it throughout Central and Western New York, Central Michigan and Eastern Wisconsin.

2. The second species to which I refer also bores the *Typha.* I have called it in my MS. *Nonagria subcarnea* in allusion to the carneous hue of the mature larva and that of many of the moths, especially when recently from the pupa shell. The females expand from 42 to 46$^{mm.}$ the males 35 to 38$^{mm.}$ Reddish-gray, head, thorax and palpi usually darker or fawn. The discal spot on primaries is black and well marked in most examples; there

are two well defined black dots between the discal and the base. The subterminal line is indicated by dots on the veinules; there is a row of black marginal lunules. The secondaries show a discal dot and in some examples a faint mesial line. Beneath, the discal dots are distinct on all the wings. The male is darker with similar markings. The moth should be compared with *N. sparganii* of Europe and *N. oblonga* Grote.

The larva may be at once distinguished from that of *A. obliquata* by the color and by the last spiracles having the usual position. It is single brooded; the mature larvæ in July prepare pupa cells in the stems; they take care not to uncover themselves, for the epidermis is left unbroken over the place for exit; the pupa rests in the lower part of the deep cell, when it dis closes the moth which, with its long clypeal spine, breaks up the tissue left by the caterpillar and escapes.

3. A third species (Chilo ?) bores the stems of Scirpus. The larval habits are quite similar to those of *A. obliquata.* It passes the winter in the dead stems; in spring it seeks the new plants, bores into them, descending below the water line. When it is time to pupate it enlarges its gallery upward above the water, bores a a hole through the side which it carefully closes with a membrane of silk; the pupa cell is then carefully lined with silk, and the pupa rests low down in the stem. The pupa is provided with sharp cusps on the free abdominal rings by means of which it works its way up and breaks up the bar to the moth's escape; the pupa skin remains in the cell.

Mr. Riley, in commenting on Dr. Kellicott's communication, said that he had been greatly interested in the facts presented, and especially as to the pupation of the Nonagria. As to the difference in the clypeal projection on the two pupæ exhibited, he thought it might be sexual, as in most cases where the clypeus was produced, sexual difference occurred, the greatest development being, so far as he had observed, not in the male, but in the female. He had recently called attention in the NATURALIST to the correlation between the produced clypeus and the horny exsertile ovipositor, and the fact that they indicated endophytous larval habit. The various methods of imaginal exit in stemboring Lepidoptera, and the structural modifications that resulted were most interesting to the philosophical entomologist. In some species, as in the Nonagria here mentioned, the clypeal point on the pupa seemed merely a consequence of the necessary point in the imago, the pupa remaining in its burrow, and the imago boring out. In others, as in *Prodoxus decipiens*, the clypeal point on the pupa permitted it to partly bore out of the stem and thus release the imago which had no homologous point, but an unarmed head. In some borers the larva prepared a little door which the imago easily pushed open, the pupa remaining inactive within its prison, while in others, closely related, the pupa did

the work by forcing itself partly out. There could be no question as to the digoneutic nature of *Arzama obliquata* at Washington, and none as to its variability, as illustrated by his specimens. He doubted the generic value of Sphida that had been proposed for this species by Grote, or whether the five described species represented more than two good ones.

Cantharis nuttalli injuring wheat.—Mr. Riley exhibited wheat which on the intelligent testimony of Mr. T. S. Roberts, of Minneapolis, had been injured by *Cantharis nuttalli.* The beetles were abundant in some of the wheat fields of Dakota, and ate into the grain while it was tender.

Adjourned to meet at the call of the president.

INSECTS AS FOOD FOR MAN.—In the NATURALIST for May, on p. 546, mention is made of the practice of insect-eating by the natives of Africa. In the interior of Australia the natives are very fond of a large Coleopterous larva found in the bark of certain species of Eucalyptus. They eat them generally raw, holding them by the head and biting the body off as we would a cherry. They also cook them in the hot ashes and eat them.

I have never eaten them raw, as my courage was not sufficient, but they are very nice when cooked in the ashes, tasting something like roasted chestnuts.

Similar larvæ of moths, etc., are eaten by the natives all over the continent. But I have never seen them eat earthworms or raw snails, as some writers have stated.—*Edw. B. Sanger, Rockville Center, Long Island, N. Y.*

OCCURRENCE OF JUNONIA CŒNIA AT NATICK, MASS.—On the 17th of August I had the good fortune to see a specimen of *Junonia cænia* flying by the roadside in this town. Unfortunately I had no means at hand for capturing it, so didn't get it, but am sure of its identity, as I am familiar with the species from southern specimens which I have had for a number of years in my collection.

I will quote for you the following from a note lately received from Mr. S. H. Scudder concerning *cænia*: "You will find in *Psyche*, Vol. II, p. 276–7, a list of New England localities for *cænia*, as far as I knew them four years ago. Nearly all the captures or sights were of single individuals, and were along the coast or in the larger river valleys. The farthest north known to me is at the southern extremity of Maine, just north of Portsmouth, N. H."—*E. J. Smith, Natick, Mass.*

THE COLORADO POTATO-BEETLE.[1]—I noticed in 1882 in my garden in Perry county, Penna., that there was no second brood of the potato-beetle. Inquiry and examination in the neighborhood showed that the fact was generally true. I was curious to

[1]Abstract of a paper by Professor E. W. Claypole, read in Section F at the late meeting of the A. A. A. S.

know why the insect thus appeared to be single brooded in the county, and purposed to make farther investigations in 1883. But in 1883 the potato-beetle almost failed to appear at all. For the first time, in my experience, since its arrival in the Middle States I saw the potatoes growing free and strong. Here and there a solitary specimen might be caught and a few nests of eggs and larvæ were destroyed, but there was no occasion to use poison at all. My neighbors were equally free, and during a journey to New York I observed everywhere the same immunity. Letters also from my former residence in Ohio told me that the same condition prevailed there. I think, consequently, we may accept it as true, that the potato crop has this season grown with less mischief from its great foe than at any time since the first invasion.

I wish, however, to call attention to the fact that the cause of this great diminution in its numbers must be sought, not during the past winter but in the preceding summer; yet that summer, 1882, was marked by no abnormal climate or weather; it was neither very hot, cool, dry nor wet. On the other hand the summer of 1881 was intensely hot and dry, the thermometer at one time marking 100° for five successive days, yet all through that summer the beetles were excessively abundant and injurious, and several applications of poison were needed to keep them within due bounds. The first beetle crop of 1882 was also as abundant as usual, so that to the great heat and long drought of 1881 cannot be due the diminution here pointed out.

Rare Monstrosities.—At the Entomological Reunion at the Royal Aquarium, London, on March 5 of this year, Mr. E. H. Jones exhibited a larva of *Melanippe montanata*, which constitutes an abnormity of extreme rarity, the larva having the well-developed antennæ and prolegs of the imago. The specimen is figured in the June number of the *Entomologist*, 1883, p. 121, but the notes given by Mr. Jones are unfortunately rather scant. It appears that the specimen came from a batch of eggs hatched August, 1822, and was fed indoors during the winter. The antennæ were found to be developed February 15th, and the legs "became perfect" two or three days after. Both antennæ and legs then gradually shrank and dried, and the larva was killed on the 20th February in order to preserve the specimen.

A five-winged specimen of *Zygæna minos* is figured and described by Mr. Rogenhofer in the Proceedings of the Vienna Zoologisch-Botanischer Verein, 1882, pp. 34–35. In this rare monstrosity the fifth wing is between the two normal wings of the left side. It is of the form of the hind wings, but smaller and shows the coloration of the front wing. The venation is, however, quite peculiar. Only a few similar deformities are on record.

The Nervous System of Insects.—Professor Ed. Brandt gives the results of his studies of the nervous system of the larvæ of Dip-

tera of the families Leptidæ, Bibionidæ, Xylophagidæ, Therevidæ, Dolichopodidæ, Fungicolæ, Limnobiidæ and Tabanidæ. Thirteen ganglia, two cephalic, three thoracic and eight abdominal, is the normal number in all the families except the last, but Rhyphus (Fungicolæ) has the two last abdominal ganglia fused together. The Tabanidæ have only seven ganglia, one cephalic (no infra-œsophagean ganglion), one thoracic and five abdominal, the three first distant, the last two approximated. "Thus the nervous system of the larvæ of Tabanidæ constitutes an intermediate form between the nervous system of the larvæ of the Muscidæ and that of the larvæ of the Nemocera and some other families of dipterous insects."——The same naturalist writes upon the nervous system of *Stylops melittæ* and *Xenos vesparum* (Strepsiptera). In the head the ganglion supra-œsophageum only is present, the thorax has one large ganglion with five nuclei; and the abdomen a single oval ganglion connected with the thoracic ganglion by a long and thin cord. The thoracic ganglion is divided into two parts, the first corresponding to the ganglion infra-œsophageum and the first thoracic ganglion of other insects; while the posterior and larger part corresponds to the other thoracic ganglia and to some abdominal ganglia.

HYMENORUS RUFIPES AS A MYRMICOPHILOUS SPECIES.—What we stated on p. 748 of the last volume regarding the habits of the larva of the above-mentioned species has been corroborated this spring. We have reared the beetle from larvæ found by Messrs. Th. Pergande and E. A. Schwarz in large numbers in the nests of *Formica fusca* in the vicinity of Washington. This ant constructs its nest of loose soil, and there are very few straying sticks or other vegetable substances in those nests which are likely to serve as food for the Hymenorus larvæ, and the food-habits of the species remain, therefore, a mystery.

MIGRATION OF PLANT-LICE.—You will perhaps have seen in the *Comptes Rendus* that I discovered this year the full cycle of life of *Tetraneura rubra* migrating from the roots *Triticum repens* to the trunks of the elms (*Ulmus campestris*). Now I wait anxiously for the first leaves to see if the young issuing from the fecundated egg give me the *Pseudogyne fundatrix* forming the corresponding gall. I have but little doubt that it will be so, because the winged *pupifera*, obtained at the grass roots, shows entirely the same characters as the *emigrant* of the galls, and the very same day I found the insect at the grass roots I found it also under the elm bark. Kessler writes me that "*without knowing where they go*," he has ascertained this year that species of Aphis left the trees, on which he observed them, in June and came back on the same in October. The species observed are *Schizoneura corni*, *Aphis padi*, *A. evonymi*, *A. viburni*, *A. sambuci*, *A. mali*, *A. pyri*, and *Siphonophora platanoides*.—*J. Lichtenstein, Montpellier, France.*

RECENT PUBLICATIONS.—Jules Lichstenstein has republished in condensed form, under the title of "L'Evolution biologique des pucerons en général et du Phylloxera en particulier," the views on the life-history of the Aphididæ that he has of late years so often repeated in numerous journals. Aside from his peculiar nomenclature, which no one seems to follow, there is a partial bibliographical sketch of the principal works on the subject.—— Dr. Raphael Blanchard has just issued from the press of La Société Zoologique de France, at Meulan, a well printed work of 116 pages, on "Les Coccides Utiles," in which he has brought together in systematic order what is known of the useful species of scale-insects.——Professor J. H. Comstock has published as a report of the "Department of Entomology of the Cornell University Experiment Station," that portion of his report to the Department of Agriculture for 1881, which was omitted a year ago for want of space. The contents are, unfortunately, not indicated on the title even of the author's edition. The work forms a most useful compendium of what is known af the Diaspinæ, with a list of other described N. A. Coccids. Indices to the species and to the plants are given, and we regret that a bibliography was not added. The author seems not to have been aware of what we have written on *Chionaspis pinifolii* (Fitch), or on the Dorthesias of Fitch being the egg-covering of *Enchenopa binotata* Say.—— Mr. A. E. Brunn gives in the same pamphlet, and has issued in separate form, an interesting paper on the Tineidæ infesting apple trees at Ithaca, the species treated of being *Lithocolletis cratægella, Ornix prunivorella, Aspadisca splendoriferella, Tischeria malifoliella* and *Bucculatrix pomifoliella.*

ENTOMOLOGICAL NOTES.—The most noticeable entomological articles contained in the *Annals and Magazine of Natural History* during the first six months of this year are as follows: Notes on British Spiders, with descriptions of three new species and characters of a new genus, by the Rev. O. P. Cambridge; the generic name Amphissa is preoccupied by a gasteropod mollusk. The same author also describes four new European spiders.—— Notes on Lepidoptera from Japan and the Corea, and also from Melbourne, by A. G. Butler. The Corean collection represents an instructive combination of Japanese, European and Chinese features. Four new Corean and nineteen Australian species are described.——Mr. Butler also describes three Myriopoda of the genus Zephronia from the East Indian region, three of Spirostreptus from Madagascar; three new genera and as many species of Blattariæ, two of them from Madagascar; two species of the homopterous genus Platypleura from Madagascar, and one of Aphæna from Sumatra.——F. P. Pascoe describes numerous Coleoptera, chiefly from the Indian and Australian regions and South America. He complains that "Drs. Horn and LeConte have given us excellent accounts of the United States

species, but they sternly refuse to look at any other forms than their own. Dr. Horn finds fault with some of us for not studying the American species, but collections from the United States rarely or never come into the market."——The same naturalist makes considerable additions to the Australian Curculionidæ, describes a new Mantis from Pará, and gives a classification of the Homoptera. Thirteen families of this sub-order are defined, exclusive of the Aphidæ, Coccidæ, etc. (Phytophthiria), which are considered to belong to a lower group, and also of the Thripidæ, which he regards as higher.——C. O. Waterhouse describes nine new Longicorns, three Buprestids and four Cetoniids from Madagascar, and some Buprestids and Heteromera from various localities.——J. Wood Mason describes two new Indian Papilios, and notes that the scentless group to which one of them belongs mimics the strong-scented and nauseous Philoxenus group.—— Mr. H. W. Bates describes four geodephagous Coleoptera from Northwest Mexico; and W. L. Distant two Rhopalocera from the Malay peninsula.——M. Viallanes (*Comptes Rendus*, November 14, 1881) remarks that in *Musca vomitoria* a pupa of from two to four days standing is embryonic in structure, consisting only of "two layers of central cells, one forming a solid cord composed of the epithelial cells of the digestive tube, which have reverted to the embryonic state, the other peripheral, consisting of the embryonic cells originating from the muscular nuclei and the cells of the adipose body. When the tissues of the larva are destroyed the tissues of the adult form." The histoblasts are composed of two laminæ, the outer thin, the inner thick. The outer disappears, the inner increases to form the integuments of the adult.——M. J. Lichtenstein (*Comptes Rendus* Feb. 20, 1882) describes the apterous male of *Acanthococcus aceris*, and mentions two or three other Coccidæ, the males of which are apterous.—— W. J. Holland states, on the authority of Dr. Jno. Hamilton, of Allegheny, Penna., that the male *Eupsalis minuta* uses his jaws in extricating the proboscis of the female from the bark of the tree in which she sometimes gets stuck in boring a hole for oviposition (Bull. Brooklyn Ent. Soc., VI, p. 48).——Franz Löw gives (Wien. Ent. Zeit., September, 1883) good reasons for believing that the Sciara which Professor J. H. Comstock described as the author of the ocellate gall on red maple (Rep. Dept. Agr. 1881–2, p. 202) is not the architect. The larva figured shows it to be a true Cecidomyia, as Osten Sacken concluded. Sciara is not known to make galls, yet it is much more easily reared from the ground than Cecidomyia, and those not careful are very apt to make the mistake that they are getting the true gall-maker. Our experience corresponds with Löw's, and he is undoubtedly correct.——In the last issue of *Psyche* (Vol. IV, Nos. 111–112) Dr. Geo. Dimmock concludes a most careful and interesting study of the scales of Coleoptera. It is a

treat to read after an author as painstaking and original as Mr. Dimmock.——In the same number of *Psyche* appears a posthumous paper by Mr. V. T. Chambers on the "Classification of the Tineidæ."——Mr. E. B. Reed has compiled a General Index of the Entomological Reports of the Province of Ontario, from 1870–1882. It consists of (I) List of Illustrations, (II) Classified list of Illustrations, and (III) General Index. These are prepared somewhat after the style of our "General Index to the nine reports on the Insects of Missouri," except that the original sources of the illustrations are not given, which are to be regretted, as they are, for the most part, not credited in the reports. An index to food-plants would also have increased its value. One of the most noticeable errors is in the index, where we find "*Caloptenus septemdecim*, v., 31." There is no such name on p. 31 of Vol. v, but on p. 30 there is a reference to *C.* [*icada*] *septemdecim*. On the whole, however, the compiler's work has been well done, and it will be found most useful to those who have occasion to use the reports.

ZOÖLOGY.

THE DEEP-SEA FAUNA.—What is to be understood by the deep-sea fauna, and by what physical conditions its occurrence is governed, are questions of which Professor T. Fuchs attempts a solution in a paper published in the "Transactions" of the Austrian Geological Survey, and translated in the *Annals and Magazine of Natural History* for January, 1883. After enumerating the most characteristic deep-sea types, mostly vitreous sponges, corals, Brachiopods, Crinoids, Echini, a peculiar starfish (Brisinga), and a peculiar group of Holothurians (Elasmopoda), and the ribbon-like fishes, he shows that the passage of the littoral into the deep-sea fauna is gradual; but that over all the earth, at a depth of from 90 to 100 fathoms the deep-sea forms begin to be found. He regards the line of fifty fathoms as the ideal boundary line between the littoral and the deep-sea fauna, and that this depth is pretty nearly the same in all seas. Below thirty fathoms no plant life exists except a few straggling nullipores which, in the Mediterranean, extends to a depth of 150 fathoms. In the tropics, Fuchs claims, there is a comparatively sterile region, extending from about thirty to ninety fathoms; but no such region exists, as is well known, in the temperate and polar seas.

Now, he asks, by what physical conditions is this boundary line of fifty fathoms determined, and what, consequently, is the true conditioning cause of the appearance of the deep-sea fauna? With Dana he claims that temperature plays but a very subordinate part in the distribution in depth of sea animals. Among the facts he brings forward to prove this is the absence of deep-sea forms in shoal water in the Arctic regions, where the temperature is the same as at the bottom of the sea in the tropics. "In the

littoral region of the Arctic and Polar seas we find no traces of deep-sea corals and Brachiopoda; of vitreous sponges, Echinothuriæ and Pourtalesiæ; no trace of Crinoids, Brisingæ, Elasmopoda, or of that swarm of remarkable Crustacea and fishes which characterize the deep-sea fauna. All these forms of animals occur, indeed, in the Arctic seas, but here also always, only in the deep water, and not in the littoral region; and here the general contrast between the littoral and deep-sea faunas is just as sharply defined, and in the same manner as in warmer seas." Many so-called "Arctic" animals found at great depths in southern latitudes, do not occur in the littoral region in the Arctic seas, but are there confined to the deep water as in warmer seas. After discussing the influence of temperature, the chemical conditions, and the movements of the sea, Fuchs claims that light is in reality the only factor that can be taken into consideration.

"Light is the most powerful factor amongst all the agents which influence life upon the earth, and its importance is generally overlooked only because, on the surface of the earth, it is everywhere pretty uniformly distributed, and therefore gives but little occasion for the production of differences. But in the sea the conditions are quite different. The light as it penetrates into the water is gradually absorbed by the water. It is thus gradually changed, and finally entirely absorbed, so that at a certain depth the sea must be perfectly dark. It is to be remarked, however, that the relation of the sun's light to the water of the sea is not perceptibly modified either by the temperature or by any existing variation in the chemical composition of the water, and that, therefore, this relation must remain pretty nearly the same over the whole earth. If we now place this condition vividly before us—the enormous mass of the sea; above, a thin illuminated zone, below, a great dark mass—the conviction must, to a certain extent, *a priori*, force itself upon us, that this fundamental difference in the external conditions of life must find expression in a corresponding difference of the living world."

From the experiments of Secchi, Pourtales and Bouguer, the inferior limit of light in the sea lies between forty-three and fifty fathoms, this being exactly at the depth Fuchs fixed upon at the outset as the boundary line between the littoral and deep-sea faunas. Hence, there can scarcely any longer be a doubt, he adds, "*that* the difference which is produced in the fauna of the sea by its conditions of light is no other than that which we distinguish as littoral fauna and deep-sea fauna; in other words, that the littoral fauna is nothing but the fauna of light, and the deep-sea fauna the fauna of darkness.

Fuchs has shown, on a previous occasion, that the depth already mentioned of 43–50 fathoms, found by Secchi, Pourtales and Bouguer, cannot represent the absolute limit of light; but that small quantities of light, no doubt, penetrate considerably

deeper into the sea, and, indeed, from the analogy of Torel's investigations in the Lake of Geneva, as far as 100–200 fathoms. Now, it is certainly very remarkable that the limit of nullipore plants occurs at 150 fathoms, and A. Agassiz cites precisely the same limit for the greater part of those littoral animals which extend beyond their normal boundary for some distance into the region of the deep-sea fauna.

Many deep-sea animals, living in darkness, either have uncommonly large eyes, like nocturnal animals, or are completely blind. It is also well known that they are, for the most part, either pale and colorless or unicolorous, and that varied coloration is exceedingly rare, while a large proportion are luminous. This last peculiarity the writer thinks of special importance, for it is clear that luminosity can be of consequence only to such animals as are destined to live in darkness.

He also refers to the fact noticed, by Moseley and others, that the pelagic fauna shows a very great resemblance to the deep-sea fauna. It is well-known that by far the greater part of the pelagic animals are animals of darkness, dwelling during the day in the obscure depths of the sea, and only coming to the surface at night. Luminosity is also as common among pelagic as deep-sea animals.

If it be true that animals of the abysses of the ocean are fitted for life in perpetual darkness, then animals must occur in the caverns and grottos of the sea which show a certain resemblance to deep-sea animals, or even directly agree with them. "For example, in the great depths of the Lake of Geneva there is a blind Amphipod (*Niphargus stygius*), but precisely the same animal occurs in springs as well as in the caverns of Carniolia, and exactly similar species are known from American caves. Moreover, the case is precisely the same with the blind Isopod, genus Cecidotæa, which occurs both in the great deptes of the Lake of Geneva and in the American and Carniolian caves. Among the most abundant and characteristic of deep-sea fishes are those near allies of the Gadidæ, the Ophidiidæ, and among them several blind species occur. Now, it is certainly very remarkable that two blind Ophidiidæ, showing the closest resemblance to their relations of the deep sea, are found in the caves of Cuba."

In conclusion, Fuchs refers to the geological bearings of the subject. He had previously shown that, during the geological periods, when a warmer climate than at present prevailed at the poles as well as elsewhere, a higher, perhaps even sub-tropical temperature must have prevailed down to the bottom of the sea. If the conditions of temperature had been the governing factor in the bathymetrical distribution of organisms, we could not at once apply the present relations of the deep-sea fauna to previous geological epochs, and in general we should lose all reliable foundation for judging of the faunistic conditions of geological

epochs. But when we know that the deep-sea distribution of animals is determined, not by temperature, but by light, we may, with perfect justice, assume that the fundamental features of the bathymetrical distribution of marine organisms have mainly always been the same as now.

VAMPYRELLA HELIOPROTEUS, A NEW MONERON.—T. W. Englemann describes this new organism, which he found among Confervæ in the neighborhood of Utrecht. It is distinguished from all previously known forms by the " heliozoa-form " (globular, with long pseudopodia), being able to pass over into the round, flat, discoid amœba-form. This metamorphosis was observed in three instances, and extended over about five minutes. In the heliozoa-form the organism moves by means of its long, contractile pseudopodia, like an Actinosphœrium; in the amœba-form it creeps without pseudopodia or change of form. It bears a very close resemblance to *Hyalodiscus rubicundus* (Hertw. and Less.), differing only in the absence of a nucleus and of contractile vacuoles. The author adduces, from the discovery of this organism, a fresh argument against drawing any sharp line between the different sections of the Protista.—*Journ. R. Micr. Soc.*

DIMORPHISM OF FORAMINIFERA.—MM. Meunier-Chalmas and Schlumberger, attracted by the discovery by one of them of the presence of two forms in every species of Nummulite, have lately directed their attention to the Miliolidæ, where they have observed similar phenomena; so that dimorphism is to be detected in both the great divisions of the Foraminifera—Perforata and Imperforata. The dimorphism of the Foraminifera is characterized by a difference in the size and arrangement of the primary chambers; the smallest and those of a medium size have a ventral chamber which is relatively very large (Form A), while in larger forms this cavity is only visible when highly magnified (Form B). For a given species no external character, save that of size, would give the least suspicion of this difference.

The authors proceed to give some details of the distinctive characters of the two forms, and promise, in a further communication, to discuss the hypothesis by which this remarkable difference may be explained.—*Journ. R. Micr. Soc.*

NEMATOPHORES OF THE HYDROIDA.[1]— C. de Mereschkowsky has investigated the structure of the nematophores with regard to the general view that they consist not of cellular tissue but of a structureless protoplasmic mass. He finds that these organs not only consist of cells, but that an ectoderm and endoderm and even a membrana propria are also present. The endoderm forms a solid axis, which at the base of the organ unites with the endoderm of the stem. The ectoderm, which covers it, is alone the

[1] Bull. Soc. Zool. France, VII (1882), pp. 280-1.

seat of the amœboid movements, which take place chiefly at the superior extremity, where the endodermic axis is wanting. The cause of the movements is explained by the structure of the ectoderm. Its cells are immersed in a contractile protoplasmic mass, to whose contractility the movements are due.

Though these organs have no cavity they may be considered as degenerated polyps: (1) Because their tissues are the same; (2) because each has a calyx, and (3) because the polyps can, in certain circumstances, transform themselves into a nematophore.

The author's observations were made on one species of Plumularia, two of Antennularia and two of Aglaophenia. In the case of one of the latter he found that the tissues constantly contained parasitic alga; the endoderm "yellow cells," and the ectoderm a green alga belonging to the Phycochromaceæ.—*Journal of the Royal Microscopical Society.*

"CHALLENGER" HOLOTHUROIDEA.[1]—The first part of H. Théel's report on the *Challenger* Holothuroidea is devoted to the new order Elasipoda, which name has with advantage been substituted for that of Elasmopoda, used in the preliminary report. Seven years have scarcely elapsed since the discovery in the Kara sea of the form for which this family was established, and now over fifty species are known. These species of Elasipods are true deep-water forms, and they may, with all the more reason, be said to characterize the abyssal fauna, as no single representative, as far as is at present known, has been found to exist at a depth less than fifty-eight fathoms. Only one form, *Elpidia glacialis*, has here been dredged at such an inconsiderable depth, and even this was dredged in the Arctic ocean, where true abyssal forms are to be met with at comparatively shallow depths. This species, too, can exist at immense depths, one form, Station 160, having been dredged at a depth of 2600 fathoms; the greatest depth at which any Holothuroid has hitherto been dredged being 2900 fathoms.

Among the more remarkable and distinguishing characteristics of this order, Herr Théel mentions the agreement in several important details, both in their internal anatomy and outer form, of the adult and larval states; an agreement more close than occurs in any previously known Holothuroid. He does not agree with Danielssen and Koren in placing the Elasipods low in the series of the Holothuroids; nay, in some respects he regards them as having attained a higher development than all the other Echinoderms, because among other facts their bodies are distinctly bilaterally symmetrical, with the dorsal and ventral surfaces distinct, and often with a cephalic region well marked. Only the ventral ambulacra are subservient to locomotion; these latter show a tendency to appear definite both as to place and number.

[1] Reports on the Scientific Results of the voyage of H. M. S. *Challenger* during the years 1873-6, Vol. IV (1882), pp. 176, and 46 pls. Cf. *Nature*, XXVII.

The dorsal appendages are so modified as to perform functions different from the ventral ones. The report gives full details of all the new species.—*Journal Royal Microscopical Society.*

A NEW UNIO FROM FLORIDA.—A Unio from the lakes of Sumter county, Fla., has recently been described under the cognomen of *Unio cunninghami*, by Professor Berlin H. Wright. It is near *Unio buckleyi*, but differs from that species in the absence of rays in all stages of growth, its greater diameter, more angular anterior portion, its abrupt posterior slope and heavy, oblique cardinal teeth (Proc. Acad. Nat. Sci., Phila., p. 58, pl. 1, figs. 1–4).—*A. F. Gray.*

NEW LAND SHELLS FROM TENNESSEE.—*Zonites wheatleyi* and *Zonites petrophilus* are described from The Cliffs, Knoxville, Tenn., by Mr. Thos. Bland. The former, which has also been found at Tiverton, R. I., is related to *Z. viridulus* Mke., from which it differs in the form of aperture, in the descending last whorl and in having a wider umbilicus. The latter resembles *Z. arboreus* Say, in its general form, but varies in color, more developed striæ, and has a much wider umbilicus than that well-known species (Annals N. Y. Acad. of Sci., pp. 368–369). Both species are well figured.—*A. F. G.*

THE FRESH-WATER SHELLS OF COOPER'S CREEK, CENTRAL AUSTRALIA.—There are three genera of Gasteropoda, Physa 3 sp.

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5.

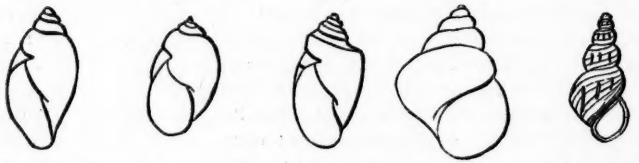

FIG. 1.—Physa. FIG. 2.—Physa. FIG. 3.—Physa. FIG. 4.—Paludina. FIG. 5.—Tryonia. All nat. size.

(Figs. 1–3), Paludina 1 sp. (Fig. 4), Tryonia 1 sp. (Fig. 5), and

FIG. 6.—Anodonta. Nat. size.

one of Lamellibranchiata, Anodonta 1 sp. (Fig. 6).

The gasteropods die when the water in the creek dries up, but each flood stocks the creek again by bringing down young ones which one can see in all stages of growth in the flood water. The Anodonta lives all the time. When the water dries up it buries itself in the mud, going deeper and deeper. I have seen the natives dig them out alive from a depth of four or five feet eight months after the water had disappeared from the surface. The natives eat them, and large heaps (kitchen-middens) consisting mainly of their broken shells mixed with the bones of animals, are common along the creek. I have eaten them and found them to be remarkably tough.—*Edward B. Sanger.*

NOTE ON THE OCCURRENCE OF TWO GENERA OF BRANCHIOPODA IN THE AUSTRALIAN DESERT.—The sandhills and stony plains that cover the greater part of the interior are but seldom visited by rain, sometimes not for a period of two or three years. Consequently all animals living habitually in this region are capable of doing without water for long periods. After a rain the water collects in shallow pools on the clay-pans and in hollows on the stony table-lands, but it is soon evaporated by the fierce sun.

One day after a shower (the first in two years), as I was riding across a clay-pan, I observed a strange rippling of the water in one of the shallow puddles. On examination I found the water to be swarming with a species of Apus. They were of a large size, measuring about an inch across the carapace. Now the astonishing part is, that the rain had fallen two days before and that that was the first time it had so done for certainly two years. The clay-pan was in the sandhill country, sixty miles away from any watercourse, and, moreover, there had been no flood for two years in any of the watercourses. And anyway a flood would never reach this spot. There that clay-pan had been baking in the sun, swept by the hot wind, covered and uncovered with drift sand, and yet two days after a slight shower the pools were swarming with full-grown specimens of Apus.

A few miles further on I camped on the stony plains by a small pool of water collected from this same rain; in this I found dozens of a species of Limnetis, a great number of tadpoles and a *young fish* about an inch and a half long, which I vainly endeavored to catch. Now this seemed to me more wonderful than the occurrence of Apus. How could the egg of a fish exist that length of time in earth baked like a cinder? How could any living egg exist? It seems impossible, but I can conceive of no other explanation. The eggs must have been buried rather deeply and then when the moisture reached them developed rapidly. Then again how did the fish eggs get there? Transported probably by some bird during some previous rain? In the face of facts like these we must grant that animal germs have far more vitality than we are accustomed to grant them.—*Edw. B. Sanger.*

PRAIRIE RATTLESNAKE.—Since September last I have had a prairie rattlesnake (*Caudisona tergemina*) in confinement. Two points have interested me in his history. So far as I know he has not eaten anything since his capture. In May last he shed his skin without a break in it. On the 2d instant he repeated the operation. Is this common among the snakes? I had supposed that generally the skin was changed but once a year. He has seven rattles.

P. S.—The rattlesnake referred to has at last taken food. For two or three months after his capture in September last, we tried him with frogs, toads, mice, &c., but he would not touch them. Occasionally some small animal has since been introduced into the cage. Finally on the 6th instant (Aug.) an English sparrow was put into the cage, and in a very short time it was killed and eaten. To fully swallow the bird occupied about thirty minutes. —*E. A. Gastman, Decatur, Ill.*

SHORT-EARED OWL.—The following, which is decidedly the most interesting information so far placed on record, was furnished by Mr. H. A. Kline at our request, after purchasing from him a set of eight eggs. Mr. Kline makes no vague statements, but gives us interesting facts as he observed them, and in a straightforward manner:

"My first acquaintance with this bird was in the spring of 1880 while on a ducking expedition in the Winnebago swamps of Illinois. As I was tramping through the dry grass along the edge of a marsh, and on the lookout for more edible game, a pair of these birds was flushed from the tall grass. I succeeded in winging one with the right barrel, and after sending 1½ oz. of No. 5 shot after the other in vain, I proceeded to examine my prize, which proved to be a male in fine plumage. I afterwards learned of several being killed in the same locality. I found these birds very common in Johnson and Gage counties, Nebraska. On one occasion while out shooting prairie chickens in the winter of '81–'82 I noticed one of these birds rise from the grass about fifty yards in front of me. A load of shot soon brought it to the ground, when at the report of the gun four others rose from the grass, all of which were within fifty yards of me, but they were all very shy and kept well out of range. They seemed very loth to leave the place, as I found them in the same locality every day for a fortnight. They were very wild, but I succeeded in taking two more good specimens. The site where these birds were killed, was along an old ravine, which was covered with a heavy growth of prairie grass. I could notice no variation in the markings of any of these birds. I did not disturb the birds at that place after securing the three, as I thought they would breed there, and I often noticed four or five of them flying about after sundown in search of mice, etc. They appeared to be common

anywhere on the prairies, although I always met with best success along the ravines. On the 17th of May I took my dog (a pointer) and went to the same place where I got my specimens to look for their nest, which I found without much trouble. The dog was ranging a short distance in front of me when he was suddenly attacked by one of the owls; it was soon joined by the other (the male), and together they succeeded in driving him from the field. They would swoop from the right and left, and strike him on the back with their wings. Not being used to such treatment by any members of the feathered tribe, he beat a hasty retreat, followed by both birds. After chasing him some distance they returned to me and manifested great displeasure by swooping very close to me and snapping their bills as many owls do when angry. I soon came upon the nest, which was placed upon the ground, and contained eight white eggs. They were of an oblong oval shape, and the shell closely resembled that of the long-eared owl, though the eggs are not near as round as the long eared owl's, being much less through the lesser axis. The nest consisted of a mass of dry prairie grass placed on the ground, and was hollowed out two inches deep. The interior was lined with fine grass, and the whole displayed a good bit of skill in nest-making for an owl. The eggs of this nest are now in the possession of Jos. M. Wade, Boston, Mass. The same week I found two more nests, both of which were destroyed by fire before the set of eggs was completed. One of these nests was on a high knoll, and the other in a ravine. A gentleman who had been watching these birds for several years told me he found a nest in 1880 which contained six young birds and one egg. The young varied much in size and must have been hatched at different times. The eggs of the first set I found showed the same variation in the size of the embryo. I don't think these birds ever prey upon anything but small animals, and I have never found them in the vicinity of timber. I have tried trapping them by placing a steel trap on the top of a pole, but never succeeded in catching a bird."

The following received from G. A. McCallum, Dunville, Ont., is also a valuable addition to the life-history of this bird:

"A flock of short-eared owls, that is, if six may be called a flock, have taken up their residence in the outskirts of our town this winter (1882–3), and as many as four have been seen together flitting about the fields as if in play, dipping down to the ground, then soaring up again, chasing each other, etc. Is this conduct not odd? I have secured two of them, and hope to bag the rest, although they are very wary. A friend of mine while shooting in the marsh last fall had just shot a snipe, when one of this genus darted at the falling bird and had secured it, when the other barrel dropped him, and he now sits in my collection."—*A. D. Butterfield, San Jose, Cal., Oölogist and Ornithologist.*

HABITS OF THE PANTHER IN CALIFORNIA.—It is difficult to acquire much knowledge of the habits of panthers in their wild state. There are some peculiarities about the McCloud River panthers, however, which have been noticed. They will always run from a dog no matter how small he is. An undersized terrier is as good to chase a panther with as the largest hound. When the panther finds that the dog is closing upon him, he will always jump up into a tree. He will not climb the tree like a bear, but will jump up into one of the branches, and I have heard old hunters say that they had seen panthers jump over twenty feet of perpendicular height into a tree. One blow of the panther's paw would kill the dog perhaps, but the panther never stops to give the blow. It is quite possible that the panther jumps into the tree so as to be in a position to pounce upon the dog when he comes up, but whether this is their reason for resorting to a tree, or whether it is simply because it is the cat's nature to run, as it is the nature of the dog to chase, it is the fact in either case that the panther always runs from the dog, no matter how small he is, and never turns to face him.

The behavior of the panther is no less peculiar after he has jumped into the tree, for when there he watches the dog constantly, no matter how near the hunter comes up to him. This makes it a comparatively safe and easy thing for the hunter to shoot a treed panther if the hunter has a dog with him, for while the panther's eyes are fixed on the barking and excited dog, the hunter can go as near as he pleases, and take as slow and deliberate aim as he pleases. As long as the dog remains barking under the tree and absorbing the panther's attention, the hunter is perfectly safe. All he has to guard against is wounding the panther without killing or wholly disabling him, in which case the victim might, in his dying struggle, encounter the hunter and do him a serious injury.

Panthers are seldom seen roaming about by day. It is believed that they are in the habit of hiding in trees in the daytime, partly perhaps for safety and partly for the purpose of watching for food. On the McCloud river, however, I believe they spend the day, for the most part, in the inaccessible parts of the limestone cliffs which cap the mountain summits across the river from the fishery. These limestone cliffs and pinnacles are high, steep and very difficult of access. One day I followed a panther's trail far up the side of Mt. Persephone. The panthers' tracks grew thicker and plainer as the mountain side grew steeper, and the limestone cliffs came nearer. When about three thousand feet up, the mountain became very steep and precipitous and ended in a blank, smooth vertical wall of rock about twenty feet high. The panthers' tracks continued up to the very base of this rock, which of course having reached they sprang to the top of, and once there they were safe from everything. No Indian could

follow them there, no dogs could track them there, no white hunter with his rifle could reach their inaccessible retreat. In these cliffs they were safe.

It is my impression that the panther, finding so safe a retreat there, and one that is at the same time so near their food, make these limestone cliffs their home, and rear their young there. At all events the panthers' tracks that lead to our houses come from these cliffs, and the tracks that lead from our houses return to the cliffs.

It would seem that a panther's life when he does not voluntarily risk it by excessive boldness must be extremely free from danger. No denizen of the mountains or forests is his equal. In California he is called a lion, and he is well named, for like the lion he is monarch of the forest. It is generally believed that the grizzly bear is the most powerful of the wild animals of America, but the McCloud River Indians say that the panther always kills the grizzly when they have a fight. They say that the grizzly bears are afraid of the panthers, and that the panthers spring on their shoulders and cut their throats with their teeth. I imagine, however, that a panther never attacks a grizzly bear face to face. I myself have seen places in the mountains where the ground has been torn up by what must have been a desperate conflict between a panther and a bear, and the Indians have found dead bears that panthers have killed, but they say they have never found dead panthers that bears have killed. The Indians say that there seems to be the same natural antipathy between panthers and bears that there is between cats and dogs, and that the panthers are always trying to kill the young cubs of the bears, and the bears are always seeking to kill the panthers' kittens.

Panthers are seldom killed on the McCloud river. I have heard of only one or two that Indians have killed with their arrows.

It is difficult to poison or trap them, as they are so suspicious of the bait. I have heard, however, of many panthers being killed by poison in other places, and I suppose if the McCloud panthers got hungry enough they could be poisoned, but while food is as plentiful for them as it is now, it is difficult to poison or trap them. One exception to this should be mentioned. They are in the habit of burying anything that they capture and do not eat it up at the first meal. For instance, if a panther gets a deer or a hog, he eats what he wants and then digs a hole in the earth with his claws and buries the remainder. If now anyone should find this buried meat and should poison it, the panther would be killed, for he will eat the meat he has buried himself. I will merely add in conclusion, that in consequence of the difficulty of killing the panthers, they are likely to maintain their hold for many years yet in the limestone cliffs bordering the McCloud river, for although settlers are now beginning to come into

this region, the chief effect of these settlements upon the panthers will be to furnish them with a larger supply of domestic food and to drive off the hereditary enemy of the panther, the bear, while the rocky retreats where the panther makes his home will remain as inaccessible as ever.—*Livingston Stone, in Forest and Stream.*

ZOOLOGICAL NOTES.—*Cœlenterates.*— Mr. Ryder (Bull. U. S. Fish Comm., p. 165, 83) calls attention to a new enemy of the oyster brood. It appears that a species of Actinia which is very often attached to oyster shells swallows the embryo oyster, and ejects small bluish-gray pellets from its mouth, these pellets consisting of nothing but the empty shells of young oysters, the remains of the ingested food of the Actinia.

Worms.—An important and fully illustrated paper by Hugo Schauinsland, on the embryology of the Trematode worms, appears in the Jena *Zeitschrift* for July 20. The development of several species of Distomums and of *Aspidogaster conchicola* is given with more or less detail.

Mollusks.—Mr. J. A. Ryder, in his studies on the development of the oyster (Bull. U. S. Fish Comm., Feb. 1, 1883), observes that the description given by Hatschek of the first appearance of the shell in Teredo, agrees perfectly with that observed by him (Ryder) in the oyster, "and we may, as it appears to me, with safety assume that *the development of the shell in all mollusks takes place in the same way.* This admits of no question, and as the last-named investigator very justly observes, it is a weighty argument in support of the position so ably defended by Von Ihering, viz., the theory of the monophyletic descent of the Mollusca."

Crustaceans.—Of Gerstaecker's Arthropoda, Lief. 9 and 10 of the 2d part has been received; it continues the account of the Isopoda, finishing the account of their geographical distribution, their distribution in time, and begins the description of the Amphipod Crustacea. It is accompanied by six plates.

Fishes.—Mr. Ryder (Bull. U. S. Fish Comm., Feb. 13, '83) records his observations on the absorption of the yelk, the food, feeding and development of embryo fishes, with notes on small fishes and water animals which prey on fish larva, in which he shows that the transparency of larval fishes does not prevent their being devoured by larger fish. He also writes of the mechanical conditions affecting the development of fish ova, and his remarks will be of general interest to embryologists. He also claims that the protoplasm of different species of animals must have a specific character.——J. Swain and G. B. Kalb review (Proc. U. S. Nat. Mus., v, 638) the genus Noturus, describing one new species.——A little-known whitefish (*Coregonus hoyi* Gill) is described in full by Dr. J. T. Bean in the Proc. U. S. Nat. Mus., v, 658. Dr. Bean also describes a new species of Alepidosaurus (*A. æsculapius*) from Alaska.

Reptiles.—In a letter from Cape Town in the Proceedings Zoöl. Soc. London (1883, 32), G. H. R. Fisk mentions two ways in which the naturally large and rapid increase of snakes is prevented. A specimen of Saurophis laid four eggs in captivity; these were swallowed by another snake (Coronella). Lizards also destroy snakes, biting them one-third of their length from the head.

Birds.—Two years ago, says the *Scientific American*, eighty-four English skylarks were imported and loosened in Bergen county, New Jersey. This was in the spring, and it was ascertained afterward that about fifty of them paired and remained not far from where they first beat the free air of America with their wings. The lark is not a migratory bird, and it was feared that our northern winters would prove too severe for them, but during the next summer they were heard in Bergen and Passaic counties. This, the third summer of their liberty, shows yet stronger proofs of their naturalization and ability to breed here. They have been heard in more places.——A call for a meeting of ornithologists, to be held in New York city, Sept. 26, has been signed by J. A. Allen, Dr. E. Coues and W. Brewster. The name proposed for the organization, which is for scientific as well as social objects, is the American Ornithological Union.——*Science* says that when obliged to wash birds, collectors will find it an advantage to use salt and water, instead of plain water. The salt prevents the solution of the blood-globules and consequent diffusion of the red hæmoglobin.——A new petrel from Alaska is described by Mr. R. Ridgway in the Proceedings U. S. Nat. Mus (v, 656) under the name of *Œstrelata fisheri*, or Fisher's petrel.——Dr. H. Gadow has an important illustrated paper in the Proceedings of the Zoölogical Society of London, on the suctorial apparatus of the Tenuirostres.

Mammals.—Mr. A. E. Brown writes to *Forest and Stream* concerning the capture of the hooded seal near Spring lake, New Jersey, which was forwarded to the Zoölogical Garden at Philadelphia: "It was in poor condition when received, steadily refused food, and died on the ninth day after arrival, when its incisor dentition $(\frac{2\cdot2}{1\cdot1})$, the large development of claws on the hind feet, with other details, proved it to be a young female hooded seal (*Cystophora cristata*). Although a few specimens of this seal have been seen on our shores, even as far south as the Chesapeake, yet its occurence is sufficiently rare to be worthy of note, and at this season of the year it may be inferred that a considerable part, at least, of the voyage was performed on an iceberg or floe. The short life of the animal gave little chance to observe peculiarities of habit, the only ones observed being its extremely savage disposition, to a degree far greater than I have ever seen in the common seal, and its habit of floating in the water with the axis of the body almost perpendicular instead of horizontal, as with most other

seals. Both of these habits I find to be mentioned by those who have observed the animal under motion. It is much to be regretted that the specimen did not live, as its presence in the same pond with specimens of three other North American seals, the common seal (*Phoca vitulina*), the California elephant seal (*Macrorhinus angustirostris*), and Gillespie's hair seal (*Zalophus californianus*), would have offered a rare opportunity for studying the moral differences of these species. It is curious to observe that the habit of floating perpendicularly, above referred to, is shared by it with the sea elephant, which it resembles in dentition, and quite strikingly in internal anatomy, the two genera forming a group quite apart in subordinate characters from the other Phocidæ."——After the publication of this fact, Mr. J. A. Allen notes the capture of a crested seal (*Cystophora cristata*) on the coast of Massachusetts, claimed to be the first fully authenticated instance of the occurrence of any seal, except the common *Phoca vitulina*, upon the New England coast. The specimen was taken at Newburyport, and goes to the Charleston (S. C.) Museum, says *Scientific and Literary Gossip*.——Mr. Henshaw states that the West coast *Sciurus fossor* occurs east of the mountains, as does also *Spermophilus beecheyi*. The latter occurs from Carson northward, and shows no sign of inter-gradation into the *S. grammurus* form of the central region. *Lepus trowbridgii* occurs also at Goose lake, east of the Sierras.——The following note, by J. C. Hughes, of British Columbia, appears in *Forest and Stream*, and deserves to be quoted in these *Notes:* "Again, wolves (*Canis lupus* var. *occidentalis*) in the summer season live to a great extent on the numerous berries growing in this part of the world, a matter of surprise to many, as the wolf is generally considered to be strictly carnivorous in its habits. I have not been fortunate enough to see the animal myself in the act of feeding, but have been informed upon the most trustworthy statements of others who have done so, and I have seen the excrement of wolves containing a large amount of berry seeds, upon islands where there were no dogs, and where it was thus impossible for it to be theirs. I do not know that the latter ever partake of this kind of food, though it is possible that they may, as it is stated that dogs in Italy play sad havoc with the vineyards when gaining access to the grapes there growing. In this region fresh water does not appear to be an article of necessity to the black-tailed deer (*Cervus columbianus*), as on some islands in the Gulf of Georgia, which are destitute of fresh water, deer are found fairly plentiful. Do they drink salt water, or do the heavy dews afford enough for their requirements? Perhaps there is a grain of truth associated with the popular idea that bears lick their paws. Along toward spring the outside cuticle of the soles of bears' feet becomes hard, dried, and dead, and peels off in large pieces, leaving the soles of the feet with an exceedingly soft and sensitive covering. While the sole

is becoming detached it appears to annoy ursus, who endeavors to assist the course of nature by tearing it off with his teeth, and then licks the soft sole with his tongue. Perhaps he derives the same pleasure from this that the average boy enjoys in nursing a sore toe, or an elderly party in petting a favorite corn. The nutriment, however, to be derived from this barmecidal feast would be about equal to the amount of blood that could be extracted from a turnip. This circumstance may have given rise to the story. On emerging from his den in the spring the bear is a 'tenderfoot' in the literal acceptation of the word. Those persons who have had the outer skin of the palms of the hands and soles of the feet peeled off after recovering from scarlet fever will keenly appreciate the bear's unhappy condition at this period, and until the soles of his feet become again hardened, he does not travel far from his den, to which place he nightly returns until 'well heeled,' and if found before this time becomes generally an easy prey to the hunter, who has the black gentleman at a considerable disadvantage at this particular season. The tappen or plug which seals, so to speak, the intestines of bears during hibernation is not confined to this animal alone, being also found in the racoon (*Procyon lotor*); but on account of its small size in the last-named animal is not so conspicuous, and consequently not so often noticed."——In the Philosophical Transactions of the Royal Society of London, 1880, Dr. W. B. Lewis details the results of an examination into the structure of the cortex cerebri of the pig, sheep, and cat. In the two former these structures are similar, and the ganglionic cells, which in the cat are crowded round the cranial sulcus, are in these artiodactyles widely spread and uniform, while in the quadrumana and man they are widely spread and varied in development.——Dr. Dybowski publishes, in the Proceedings of the Zoölogical Society of London, a note on the sexual differences between the skulls of *Rhytena stelleri*.——Dr. H. Burmeister, the veteran South American naturalist, has just described, under the name *Nothropus priscus*, an extinct giant sloth, twice as large as any now existing, and which probably had the same arboreal habits as the Bradypodidæ of the present day. This form was found in the Pleistocene beds of the Argentine Republic, which have furnished such large numbers of extinct Edentates.

PHYSIOLOGY.[1]

THE EXCITATION OF THE VASO-MOTOR CENTERS BY INDUCTION SHOCKS.—H. Kronecker and R. Nicolaides in *Du Bois' Archiv.*, discuss the interesting question as to the strength and rate of succession of electrical shocks which most powerfully excite the activity of the vaso-motor center in the medulla oblongata when the stimuli are directly applied to it. According to present physiological views the natural impulses which proceed from nerve

[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.

centers are interrupted and not continuous in character, and it would seem probable that that rate of artificial stimulation which most powerfully excites the action of the nerve center is the rate at which the center naturally discharges its energy. The following are the results obtained during the research in question: Single induction shocks applied to the medulla or spinal cord, when the connection between these and the brain is severed, have no effect upon blood pressure, or only a slight effect, and that when the shocks are destructively strong. When middling strong stimuli were used, there was no summation of their effects until the separate shocks succeeded each other at least two to three times in one second. This slow rate of stimulation produces a greater effect in raising blood pressure when the intensity of the single shocks is increased. But the strongest stimuli of slow rate produce far less increase in blood pressure than stimuli of moderate strength and greater frequency. The most favorable rate of stimulation appears to be that at which the separate shocks succeed each other at intervals of $1\frac{1}{20}$ second. When the intensity remains constant, increase in frequency of stimulation raises blood pressure, but the maximum is reached when twenty to thirty stimuli per second are reached. The maximum effect in any case can be produced either through the application of strong stimuli of the rate 10-12 in one second or by shocks of medium strength 20–25 in a second. The maximum effect upon blood pressure is brought about later by the slow succession of strong stimuli than by the rapid weaker stimulation. After the stimulation is brought to a close the blood pressure returns very gradually to its normal level. Dogs and rabbits were the animals experimented upon.

THE FUNCTION OF THE SPLEEN.—The spleen may be extirpated from an animal without apparently producing any special disturbance; and though, from its periodical engorgement during digestion, it has been supposed to form a functional part of the digestive apparatus, we are by no means certain of its functions in the body.

Herzen comes forward in support of an old view of Schiff's, that there is a close relation between the trypsin, or proteid ferment, producing power of the pancreas and the activity of the spleen. The author makes an infusion of the pancreas of a fasting dog, and finds that it has little or no power to digest proteids, but if the same pancreas be extracted after mixing it with part of the swollen spleen taken from an animal in full digestion, it has great power of artificially digesting proteids. The conclusion arrived at, from varied experiments, is, that during the active, swollen condition of the spleen in digestion, there is produced in it a special ferment, which being transported by the circulation to the pancreas, there sets up changes which result in the partial conversion of the store material of the pancreas into the active proteolytic ferment, trypsin.

THE TUBERCLE-BACILLUS.— In two August numbers of the *Boston Med. and Surg. Jour.*, Dr. Ernst gives an extensive résumé of the literature pertaining to Koch's discovery of the *bacillus tuberculosis.* The author has made inoculation experiments upon lower animals, and he has made careful histological study of a number of human cases of the disease, and concludes that the following statements fairly represent the outcome of all investigations which have been made upon this subject:

"I. A staff-shaped micro-organism exists in all forms of the tuberculous process, and its presence has been demonstrated in them.

"II. It is more abundant in the rapid than in the slow forms of the process.

"III. Its specific nature as the cause of tuberculosis is claimed by Koch on the ground of his observations.

"IV. Its specific character has not been successfully refuted by trustworthy observations.

"V. Its value as diagnostic evidence of tuberculosis is very great, although its absence cannot be considered as excluding that process."

THE FUNCTION OF THE COCHLEA.—In the meeting of the Physiological Society of Berlin, held June 15, Dr. B. Baginsky spoke about the results of experiments which he had instituted in order to determine the function of the cochlea. It is well known that anatomical research has determined that the membrana basilaris of the cochlea, in which the terminal filaments of the auditory nerve are distributed, increases in breadth from the bottom towards the upper part; and Herr von Helmholtz had founded an hypothesis upon this to explain the differentiating perception of certain higher tones, viz., that the sound waves that penetrate into the cochlea occasion a synchronous vibration either in the broader upper half or in the narrower lower half of the membrana basilaris, so that the higher tones would excite the fibers of the auditory nerve distributed in the lower part, and the deeper notes of the fibers distributed in the upper part. In animals which are low in the scale of development there is a similar arrangement, which consists of auditory cilia of different lengths which have the same function, as the shorter ones are intended for the higher notes and the longer ones for the deeper notes and noises, and are set into synchronous vibration by them. This hypothesis has been experimentally confirmed in the case of the auditory cilia of the lower animals, and it had actually turned out true that deep notes produced vibrations in the long hairs and high notes in the short ones. Herr Baginsky now undertook to test the hypothesis of Herr von Helmholtz experimentally on the cochlea of higher animals. After he had succeeded in overcoming the great practical difficulties, he wounded the top of the cochlea of

the healthy ear in dogs which had been made absolutely deaf of their other ear, and then observed their hearing powers by means of the different notes of organ pipes between c and c'''''. On the third day after the immediate consequences of the operative interference had disappeared, it was found that the dogs responded perfectly to the notes c''''', c'''', c''', c'', but were deaf to the deeper notes. This condition remained unaltered for weeks, and when the animal that had been the subject of experiment was killed, post-mortem examination showed that the top only of the cochlea had been wounded, and that the filaments of the auditory nerve that were distributed to that portion were destroyed. Less precise were the results of the experiments in which the lower part of the cochlea was destroyed; in these cases absolute deafness occurred in a succession of cases; in other cases again, the dogs responded to high as well as to low notes, to the latter perhaps a little better; and again, in other cases, on the other hand, the dogs only responded to the notes c, c', c'', while they were deaf to the higher notes. But this condition only lasted some fourteen days; their hearing power for the higher notes set in again, and soon reached the same sensitiveness as that for the deep notes. Post-mortem examination showed in these various cases different degrees of distinction occasioned by the operation. Herr Baginsky believes that he has by his experiments, in particular by the results of lesion of the top of the cochlea, verified experimentally for the mammalian cochlea the hypothesis of von Helmholtz.—*Nature.*

PSYCHOLOGY.

HABITS OF THE BEAVER.—When I read Mr. Collins's story of beaver life in Nova Scotia during the last shooting season, I was pleased beyond expression. Here was something new, neither old hash nor guess work; here was a picture of inner life, life at home, worth all that had been previously written of the animal. I could almost see him come out in the twilight, look over his ruined house, and then set to work to restore it. I could see him lay and relay the sticks of which it was composed, working till back and shoulders ached, and then sitting up a moment to rest.

But the larger work on the dam just below was missed, a blank in natural history it is our luck to fill out, "acknowledging in, etc.," that the whole merit belongs to a sportsman naturalist, who seems, as you will see, under the circumstances of the case, to have "risen from savage to civilized life." A few days after reading Mr. Collins's narrative, I was agreeably surprised by a visit from an old friend and pupil, George Daniels, who had spent the past summer preparing subjects in the State Cabinet of Kansas. Research for that purpose led him to the adjoining Indian Territory, where he found undisturbed beaver communities among other developments of animal life. Securing three speci-

mens for the State Cabinet, the desire inculcated in his first lessons in natural history became imperative, demanding verification. Here was an opportunity to reach the inner life of an animal whose works had been repeatedly described as exhibiting human intelligence, but whose method and manner of accomplishment no one had seen.

With two assistants the dam of an undisturbed family was broken down to the bottom, displacing a large log which formed its base. Then with jeers at his "dam foolishness" his companions returned to camp; while he, secreted in the bushes close by, awaited the result.

He says: "At early twilight five beavers came out from holes in the bank and looked the devastation all over. 'Their capacity could not reach the cause, they only saw effects.' The first effort was to get back to its place the bed log. It was wet, heavy and slippery, their united strength could hardly move it, so that after tugging a quarter of an hour it was abandoned. They then went down the stream, gathering up the sticks of the old dam; the smaller ones were held above the water, the larger ones towed up, the beaver holding by the teeth and swimming by its side.

"There was standing on the bank directly above the dam, a willow tree some twenty inches in diameter. They all gathered about this tree, one on the upper side, all the others on the lower side next the dam. Those below them applied their teeth to the trunk like great gouges, all in turn as one became tired, so that in less time than a man with an axe would have done it, the tree tottered to its fall. All at once withdrew from the lower side, while the 'master mechanic' began cautiously to cut away the remaining support, this was done, cutting a little here and a little there, often looking upward, so that the tree fell with a crash squarely upon and across the crevice in the old dam. The tree was held several feet above the dam by its branches, and the beavers all disappeared in the water. I could not see what they were doing, but the tree began to settle and soon rested on the dam. They had cut off the branches which held it up.

"Then commenced the process of closing the breach. A beaver would draw up a fair 'cordwood' stick upon the dam, raise it on end, hugging it against his shoulder and neck, letting it slide diagonally up stream, leaning back against the fallen tree. In the meantime a beaver at the bottom was digging a 'post hole' and guiding the post to its place. When this was done the digger would come to the surface to breathe, while the one on the log would cut off the stick if too long for fair work. When the sticks of the old dam were all used, they would go into the bushes and soon return, backing out and dragging along a stick, which was placed in the same manner. This was repeated until the whole gap was filled. The process of covering this woodwork with earth, leaves, bog or whatever came to hand,

was done precisely as Mr. Collins described, hugging a mass against chin and neck, and swimming with hind feet and tail. And thus, forgetful of time, I watched with absorbing and often with almost breathless interest, the progress of the work, so that when darkness faded into daylight the dam was completed, the tired workers had retired, and I left for camp, repeating the resolution, 'I have killed my last beaver, the very last.'"

This is the point where the sportsman and naturalist rose from savage to civilized life.

There occurs here a question for the philosophic naturalist to settle as best he may. What was the medium of communication that made such unity of purpose and such union of effort in the accomplishment? The position of the old beaver above the tree indicated leadership, but no order, by word or sign, was given; all seemed to know what to do, and just how and when to do it.

The felling of a tree across a stream and building a dam against it, is one thing; felling a tree so it should not vary a foot from a given line, the old dam, showed an engineering skill you may possess, but which I should hesitate to assume. We must define instinct as directing a few things without forethought or previous knowledge, and repeating the same methods ever afterward. The bee builds the same cells, of the same material forever. The first and the last nest of the bird are precisely alike, and animals which dig holes in the earth have each a fashion peculiar to themselves, which does not vary; even the acquisitiveness of the ground squirrel is no thought for the morrow, since he hoards in the spring with all the industry of autumn.

But the beaver goes far beyond this. Instinct is overlapped by reason until separation is impossible, and all division lines are obliterated. He selects with engineering skill the site for a dam, then builds of such material as is at hand and of such shape as the exigences require, varying both as circumstances indicate; and conducting all with a degree of intelligence that treads closer upon the heels of humanity than that of any other creature living. Why an animal so gentle, so harmless, should be left outside the pale of civilized life, denied human association by clumsy form and unseemly personal habits, is one of the mysteries in nature not yet solved, but such is the fact. To him the step of civilization is simply and inevitably annihilation.—*B. Horsford, in Forest and Stream.*

THE STRIPED SQUIRREL "PLAYING 'POSSUM."—Mr. E. E. Fish records, in the Bulletin of the Buffalo Naturalists' Field Club, the fact that the striped squirrel (*Tamias striatus*) when caught alive, will often lie limp and apparently lifeless, till its captor, thrown off his guard, makes the opportunity for his escape possible, when the sly creature will scamper off with a sharp chitter of delight. It is well known that the gray squirrel, when hunted, will run up to the tops of tall trees and cling so closely to the

trunk of the tree that, aided by its color, which so closely assimilates it to the bark of hard-wood trees, it is difficult for an unpracticed eye to detect it. The chipmunk has the same habit in a less degree.

THE ENGLISH SPARROW "PLAYING 'POSSUM."—In the same note Mr. Fish relates the following case: "Among the birds, only the English sparrow have I known to make use of this subterfuge. One morning I saw four or five of these little pugilists engaged in a terrific fight among themselves. They had pecked and hammered one another in the slushy snow, and appeared reckless of surroundings. I stepped up quietly and with a quick movement caught one of them before he could rise to fly. He immediately put on the appearance of death and lay in my hand on his side, motionless and, as I supposed, lifeless. I smoothed his soiled plumage and stretched out his wings to examine the quills, feeling pity for the little fellow's untimely 'taking off,' killed in a brawl. I had gone a block to Pearl street, in which were large elms, when all at once, as if by magic, the little rascal straightened up and, like a flash, darted out of my hand and flew to the top of one of the highest trees, where he trimmed his disheveled feathers and regarded me with a quizzical look, seemingly well satisfied with the trick he had played me."

SENSE OF DIRECTION IN ANIMALS.—The remarkable faculty which cats, dogs, pigeons and other animals possess of returning in a straight line to a point of departure, has awakened much curiosity on the part of naturalists. Some refer it to instinct, some to intelligence similar to that of man, some to an internal mechanism which makes the animals simply automata; but none of these attempted explanations do anything towards solving the mystery. Wallace supposed that when an animal is carried to a great distance in a basket, its fright makes it very attentive to the different odors it encounters on the way, and that the return of these odors. in inverse order, furnishes the needful guide. Toussenel supposes that birds recognize the north as the cold quarter, the south as the warm, the east (in France), as the dry, and the west as the moist. Viguier, in the *Revue Philosophique*, publishes an original memoir upon the sense of orientation and its organs, in which he attributes the faculty to a perception of magnetic currents.—*Journ. Roy. Microscopical Society.*

ANTHROPOLOGY.[1]

ANTHROPOLOGY AT THE AMERICAN ASSOCIATION.—The Section of Anthropology was organized with Professor Otis T. Mason, vice-president, in the chair, and Professor George H. Perkins, of Vermont, as secretary. The vice-presidential address on the

[1] Edited by Professor OTIS T. MASON, 1305 Q street, N. W., Washington, D. C.

Scope and value of Anthropological Studies has appeared in full in *Science*.

The papers read were as follows:

1. Archæological Explorations in the Ohio valley. Altar mounds and their contents. By Professor F. W. Putnam.
2. Indoor games of the Japanese. By Professor E. S. Morse.
3. The great mound of Cahokia. By Wm. McAdams.
4. Life among the Mohawks in the Catholic missions of Quebec province. By Mrs. Erminnie A. Smith.
5. Metrical standard of the Mound-builders—by the method of even divisors. By Charles Whittlesey.
6. The Mound-builders identified. By Professor John Campbell.
7. An abnormal human skull from a stone grave in Tennessee. By Professor F. W. Putnam.
8. Typical shapes among the Emblematical mounds. The different attitudes exhibited by the same animal. By S. D. Peet.
9. Personal observations of the Missouri river mounds from Omaha to St. Louis; considered from a geological standpoint. Their invariable association with the Loess and Terrace formation. By E. P. West.
10. Osage war customs. By J. O. Dorsey.
11. Some observations on the laws and privileges of the Gens in Indian society. By Miss A. C. Fletcher.
12. An ancient village of the emblematic Mound-builders. Caches guarded by effigies. Effigies guarding the village and sacrificial places not far away. By S. D. Peet.
13. A new stand for mounting skulls. By E. E. Chick.
14. Symbolic earth formation. By Miss A. C. Fletcher.
15. The correspondence between the prehistoric map of North America and the system of social development. By S. D. Peet.
16. The Charnay collection at Washington. By O. T. Mason.
17. Kitchens of the East. By E. S. Morse.
18. Methods of arrow release. By E. S. Morse.
19. Game drives among the Emblematic mounds. By S. D. Peet.
20. Vestiges of glacial man in Central Minnesota. By Miss F. E. Babbitt.
21. High places connected with ancient villages; the religious structures common to villages in prehistoric time. By S. D. Peet.
22. A classification of the Sciences. By J. W. Powell.

Taking the papers in their order, a very brief abstract is given below, so that any of our readers may follow up a subject of special interest by correspondence with the author.

1. Mr. Putnam's paper was an evening lecture, illustrated with drawings and lantern views, delivered in one of the largest churches of Minneapolis, to a crowded and attentive audience. The subject was the account of explorations among a group of mounds near Madisonville, Ohio, in company with Dr. C. S. Metz. The elaborate construction, the varied and valuable contents, and the distinctive features of these mounds made them objects of exceeding interest. A full report will be given in a forthcoming publication of the Peabody Museum.

2, 17, 18. Professor E. S. Morse, of Salem, Mass., read three instructive papers upon his experiences in Japan and other lands

of the Orient. The sports and pastimes of the Japanese, for children as well as for adults, resemble ours in many respects, but there are many that are different. Those which resemble are much more difficult than ours, calling for much more time and patience. The evolution of the kitchen from two or three stones beneath a rude pot was well shown from the author's experiences. The most interesting of Mr. Morse's papers was a monograph on arrow release throughout the world, in past as well as in recent times. The paper was well illustrated. The author would be thankful for references to arrow release in either ancient or modern times

3. Mr. McAdams, who lives at Alton, Illinois, gave his personal observations on the Cahokia mound and its gigantic neighbors. This is doubtless the finest group of terrace mounds in the United States.

4. Mrs. Erminnie A. Smith, under the direction of Major J. W. Powell, has devoted several years to the Iroquois tribes. The last season was spent among the remnants of the Mohawks at their villages in Quebec province, where she has collected quite extensive vocabularies.

5. Colonel Whittlesey reviewed with caution the various methods of arriving at a metric standard among the Mound-builders. The works of Mr. McGee and W. Flinders Petrie were especially considered.

6. Professor Campbell brings to the identification of the Mound builders the latest investigations of European scholars in the very early Mesopotamian civilization; looking to an early Hittite migration to solve the problem.

7. Among the unique objects found by Mr. Putnam in his Madisonville mounds was a skull exhibiting some curious marks, the most notable being an excess of wormian bones and an extra parietal suture.

8, 12, 15, 21. The Rev. S. D. Peet, of Clinton, Wisconsin, editor of the *American Antiquarian*, took the occasion of the proximity of the association to the effigy mounds of Wisconsin, to discuss these interesting objects in a series of papers. A long acquaintance with the effigies enabled the speaker to bring out much new information. He showed that many enigmatical shapes were merely different attitudes of the same animal, that the effigies were always near some cache, village, buffalo or deer ford and altar mounds, in short that their function was connected in some way with daily life and worship. Dr. Peet also drew attention to the geography of our country with the phases of aboriginal culture.

9. Judge West, after sailing down the Missouri river from Omaha to St. Louis, and carefully inspecting the mounds on the shore, comes to the conclusion that they are all older than the latest river gravel formation.

10. In a minute and careful manner, assisted by diagrams, Mr. Dorsey described, from personal observation, the shape and arrangement of the Osage camp, and the intricate system of vigils, discussions, and dances preparatory to a war, a foray, or a horse-stealing expedition. This paper will be published in full by Major Powell in the Contributions to North American Ethnology.

11, 14. Miss Fletcher has been spending two years among the Indians, living in their camps, and her experiences are of the most absorbing interest.

13. Mr. Chick's apparatus for mounting delicate crania was exhibited and explained by Mr. Putnam.

16. The Charnay collection is pretty well understood from notices in *Science*, the *Century Magazine* and the AMERICAN NATURALIST.

20. Miss F. E. Babbitt exhibited a series of rude palæolithic implements of milky quartz, found in the modified drift of the Mississippi river above Minneapolis, fifteen feet beneath the surface. Quite a discussion was evoked by these rivals of the finds in the Trenton gravels.

22. The classification of Major Powell was general as regards science at large and elaborated only in the field of anthropology. The author discarded all merely biological studies, and viewed as anthropological *par excellence* only psychology, language, arts, sociology and mythology.

The meetings of this section were generally well attended, and the discussions showed that the audience were in perfect sympathy with the speakers. At the next meeting Professor E. S. Morse will preside, and Mr. Wm. H. Holmes will act as secretary.

WISCONSIN HISTORICAL COLLECTIONS.—The ninth volume of this excellent series covers the years 1880, 1881, 1882. The editor, Mr. Lyman C. Draper, has brought together much that is interesting in the early history of the State, and the following papers on archæology and ethnology :

1. Emblematic mounds in Wisconsin. By the Rev. S. D. Peet.
2. A mound near Boscobel. By the Hon. C. K. Dean.
3. Early historic Relics of the Northwest. By Professor J. D. Butler.
4. Indian customs and early recollections. By Mrs. H. S. Baird.

The first paper begins with the history of exploration among the effigy mounds, and gives many valuable bibliographic references. The author then summarizes his own studies respecting them. It is a remarkable fact that the large majority of these works were situated on the natural lines of travel and at those prominent places which first attracted the attention of settlers. The significance of the mounds is not discussed in the paper, the author's design being to describe them and to fix on paper those

shapes which are rapidly vanishing from the soil. The difficulty of making out the shape is very great, owing to the action of the elements and the hand of civilization. The figures are thus divided: First, those representing inanimate objects, such as weapons, badges and various emblems which are familiar to the native races; second, animal effigies as such, using the word animal in the sense of four-footed beasts, and all creatures inhabiting the water or land belonging to the order of Mammalia; third, the effigies of birds and winged creatures. Another division might also be added, and made to include fishes, reptiles and such creatures as have neither wings nor legs. Then follows a detailed enumeration of the forms in these classes. Mr. Peet has an original way of mixing up his figures, being almost as bewildering as some of the effigy mounds; they run Fig. 5, 1, 2, 3, 4, 6, 7, 8, 9, 24, 25, 10, 13, 11, 12, 14, 18, 16, 17, 15, 19, 20, 21, 22, 23, 30, 26, 27, 28, 29.

Professor Butler describes a visit to Aztalan, and speculates upon the method in which the bricks there found were burned. His account of the copper implements in the State Historical Society's Museum is valuable. The professor is quite a wag in his way, and is unable to repress himself even in serious company.

Iron from Ohio Mounds.—In the Proceedings of the American Antiquarian Society, Vol. II, 1883, p. 349, Professor F. W. Putnam reviews the statements of the old writers respecting metal found in the Western mounds. Mr. Atwater's iron-bladed sword, or dagger with a steel blade, is traced to that gentleman's imagination. Mr. Hildreth's silver-plated copper ornaments are thus characterized: "A careful study of the Hildreth specimens and also of the silver and iron-covered specimens in the Peabody Museum, has shown conclusively that the plating was done simply by covering the outer surfaces of the objects with thin sheets of the overlaid metal, which were closely united to the copper by pounding and rubbing, and by turning the edges over and under the slightly concave edge of the copper foundation. This method was followed in all the objects from the mounds and stone graves, where thin layers of native copper, silver or iron have been used to cover beads and disks of wood." The so-called spools of copper are now believed to have been ear ornaments, Professor Putnam having found fragments of the "Man with a broken ear." The method of producing these curious objects has been carefully studied out by the author. The next idol to be upset is Dr. Hildreth's "plate of silver, which appears to have been the upper part of a sword scabbard." This is shown to be identical with ornaments found by Professor Putnam in Tennessee mounds. The author also speaks of a similar one made of meteoric iron found in a mass of materials from the altar of a mound in the Little Miami valley, and made by hammering a mass of meteoric iron in the same way that masses of silver and copper were man-

ipulated. Professor Putnam, while correcting the misconceptions of early writers, pays a just tribute to their zeal, and rejoices that we are now able to see with clearer eyes than those who lived in the days when nearly every fact observed was thought worthless unless it could be immediately accounted for, and the unknown became intelligible by the application of the power of the imagination.

HUMAN PROPORTION.—Dr. Robert Fletcher delivered a lecture in the National Museum, last spring, on Human Proportion in Art and Anthropometry, which is published by Moses King, of Cambridge, Mass. This lecture was an outline of the various schemes of human proportion devised by artists and anatomists, with some account of the process by actual measurement which is now carried on under the name of anthropometry. The cubit or forearm (whence ell, from *ulna*) is the most ancient measure known. The foot was first employed as a measure in Greece. Other bodily measures came subsequently into use, such as the span, pace, yard (Saxon *gyrdan*, to girdle), fathom (Saxon *fadhm*, to embrace). From the earliest periods sculptors, painters, anatomists and geometricians have exerted surprising ingenuity in devising schemes of human proportion, and to these schemes we are indebted for the preservation of ethnic characteristics. Dr. Fletcher has collected the literature of these systems, and the lecture was illustrated by diagrams showing the various geometric processes followed, in all of which there is supposed to be some occult relation to all dimensions of the body, of some one special part, or that, given the dimensions of a part, the remaining dimensions could all be educed from a geometric diagram. Now anthropometry measures the living individuals by the scores, the hundreds, the thousands, and from an immense mass of measurements obtains the mean. Art and anthropometry, therefore, are to some extent antagonistic. Art seeks for the beautiful and idealizes; anthropometry seeks for the real and measures. Dr. Fletcher has added to his very interesting lecture five pages of bibliography, and refers to page 441 of the first volume of the Index Catalogue of the Library of the Surgeon General's office for a copious bibliography of anthropometry.

MICROSCOPY.[1]

TREATMENT OF PELAGIC FISH EGGS.—The transparent eggs of various Teleostei found floating on the surface of the sea present unusual difficulties in the way of hardening. I have had recourse to all the fluids commonly used for this purpose, and have failed to find any satisfactory method of hardening the yelk. Even the germinal disk cannot be well preserved by any of the ordinary hardening agents. Kleinenberg's picro-sulphuric acid, for in-

[1] Edited by Dr. C. O. WHITMAN, Newton Highlands, Mass.

stance, causes the cells, all through the cleavage stages as well as the later embryonic stages, to swell and in many cases to become completely disorganized. The embryonic stages can be hardened in chromic acid (one per cent), but the yelk contracts considerably without becoming well hardened even after three days' immersion.

All sorts of wrinkles and distortions are caused when the ova are transferred from the acid to alcohol. My best results have been obtained with osmic acid and a modified form of Meckel's fluid. This fluid, as used by Dr. Eisig, consists of chromic acid (¼ per cent) and platinum chloride (¼ per cent) mixed in equal parts. Thus prepared it causes maceration of the embryonic portion of the egg. By using a stronger chromic acid (1 per cent) and combining it as before with the same quantity of platinum chloride (¼ per cent), everything may be well preserved and hardened except the yelk. Before transferring to alcohol, after one to two days' immersion in this fluid, it is necessary to prick the egg membrane in order that the alcohol may reach the egg readily, otherwise the membrane wrinkles badly and often injures the embryo.

For the cleavage stages this fluid cannot be used with success unless the egg has been first killed by another agent; for eggs placed in this fluid continue to live for a considerable time, and may even pass through one or two stages of cleavage. It is therefore necessary to use some agent that kills almost instantly. For this purpose I have found osmic acid the best reagent. The eggs are placed in a watch glass with a few drops of sea water, and then a quantity of osmic acid (½ per cent) equal to that of the sea water is added. After 5–10 minutes the eggs are transferred to the mixture of chromic acid and platinum chloride, and left for twenty-four hours or more. This fluid not only arrests the process of blackening, but actually bleaches the egg.

After this treatment it is an easy matter to separate the blastoderm from the yelk by needles, and the preparations thus obtained can be mounted *in toto*, or sectioned. As the blastoderm is quite thin during the cleavage stages, a whole series of these stages may be mounted and studied from the surface to advantage. After removal from the acid the preparations may be stained at once, and then treated with alcohol and mounted in balsam.

Motor Nerve Endings.—Ciaccio[1] has investigated the motor nerve-plates in the depressor muscle of the jaws of *Torpedo marmorata* by treatment with double *chloride of gold and cadmium*. From the anterior third of the muscles, strips one millimeter thick were cut with scissors, the strips were then left for five minutes in fresh filtered lemon juice, washed in distilled water

[1] Arch. Ital. Biol., III, 75.

and placed for half an hour in one per cent solution of gold and cadmium, being kept dark; washed again in one per cent aqueous solution of formic acid, in which they were left twelve hours in the dark, then twelve in the light; finally kept in the dark in stronger formic acid for one day and preserved in glycerine. The fibers of such strips may easily be dissociated.

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SCIENTIFIC NEWS.

— A review in the *Nation* of Bentham and Hooker's Genera of Plants, says:

"Some idea of the progressive enlargement of the field may be had by a comparison of the number of genera characterized in these successive works. The phænerogamous genera of

Linnæus,	Gen. Pl. ed. 1,	A. D. 1737,	were.....	887
"	" ed. 6,	A. D. 1764,	"	1189
Jussieu,	"	A. D. 1789,	"	1707
Endlicher,	"	A. D. 1843,	" about.....	6400
Bentham and Hooker,	"	A. D. 1883,	"	7585

"If the last had been elaborated upon the scale of Endlicher, or with the idea of genera which is still common if not prevalent, the number of genera would have amounted to at least ten thousand. An estimate of the number of known species of each genus and higher group has been made throughout the work—a rough approximation only, mentioning first the number in the books, and the number to which, in the opinion of the authors, these may probably be reduced by botanists who adhere to the Linnæan view of species; from which it appears that upon the very strictest estimate their number, as now known to botanists, is at least 95,620. In round numbers it may fairly be said that about 100,000 species of phænogamous plants are in the hands of botanists. The five largest orders, as well for genera as for species, are the following, and in this rank: Compositæ, Leguminosæ, Orchideæ, Rubiaceæ, Gramineæ. The high standing of the orchid family in the list, will be a surprise to many. Linnæus knew only a hundred species; five thousand is now a moderate estimate—about half as many as there are of Compositæ, which hold to their proportion of one-tenth of the whole. In both families every country and district is largely peculiar in its species and types. The far greater prominence of Compositæ over orchids is owing to the vast number of individuals in the former, their paucity in the latter."

— The British Association for the Advancement of Science elected Lord Rauleigh president of the association for 1884. Among the vice-presidents elected are the Marquis of Lorne, the Marquis of Lansdowne, Sir John A. Macdonald, Sir Charles Tupper, Sir Alexander Galt, the Right Hon. Lyon Playfair, Dr. Charles William Siemens and Professor Huxley. The date of the

next meeting, which will be held at Montreal, has been fixed for the 27th of August, 1884. The programme will include a free excursion to the Rocky mountains and trips to Quebec and Philadelphia. The association has decided to invite the American Association for the Advancement of Science to become honorary members of the association during its visit to Montreal in 1884.

— The *Répertoire de Pharmacie* quotes, upon the authority of Dr. Nessler, a recipe for an insecticide which is said to have a great reputation among German horticulturists. It consists of soft-soap, 4 parts; extract of tobacco, 6 parts; amylic alcohol, 5 parts; methylic alcohol 20 parts; water to make 1000 parts. The extract of tobacco is made by boiling together equal parts of roll tobacco and water for half an hour, adding water to make up for what is evaporated. The soft-soap is first dissolved in the water with the aid of a gentle heat, and the other ingredients are then added. The mixture requires to be well stirred before it is used, and is applied by means of a brush or a garden syringe fitted with a small hose.—*English Mechanic.*

— A number of gentlemen met at the American Museum of Natural History in New York, Sept. 26, and established the American Ornithologists' Union. Those present were: Dr. Elliott Coues in the chair; Mr. E. P. Bicknell, secretary *pro tem.;* Messrs. C. Aldrich, Iowa; C. F. Batchelder, Mass.; Capt. Chas. Bendire, Oregon; N. C. Brown, Me.; Wm. Brewster, Mass.; M. Chamberlain, New Brunswick; C. B. Cory, Mass.; D. G. Elliott, N. Y.; Dr. A. K. Fisher, N. Y., Dr. J. B. Holder, N. Y.; T. McIlwraith; Dr. C. Hart Merriam, N. Y.; Dr. E. A. Mearns, N. Y.; Dr. D. W. Prentiss, Washington; Robert Ridgway, Washington; Dr. R. W. Shufeldt, La.

— A despatch from the commander of the French deep-sea expedition in the *Talisman*—Professor A. Milne-Edwards—has been received, in which he states that the expedition had so far met with complete success. The *Talisman* proceeded some distance down the coast of Africa, and then turned to St. Vincent, Cape Verde islands, sounding all the way. The vessel, at the date of the despatch, was about to proceed with the last section of her voyage—the investigation of the Sargasso sea.—*English Mechanic.*

— Under the title of Signal Service Notes, five pamphlets relating to the work of the bureau, have been issued. The fifth is on the work of the Signal Service in the Arctic regions, and contains the reports of W. M. Beebe of the Relief Expedition to Lady Franklin bay, Grinnell Land; of Lt. J. S. Powell of the Relief Expedition to Point Barrow, Alaska, and of P. H. Ray on his work at Point Barrow, from Sept. 16, 1881, to Aug. 25, 1882. Lt. Powell's report contains interesting ethnological notes.

— The muscular nerves of the torpedo or electric eel are, ac-

cording to M. Stassano, more quickly paralyzed than those controlling its electric battery. He has made experiments with curare, bergamot, sulphuric ether, strychnine and digitaline, and obtained the same general result with all.

— The French Association met at Rouen from August 16 to 25. A number of excursions were arranged, notably to Elbeuf, Dieppe, Havre and Cherbourg.

— The sudden death of Dr. Herman Müller by an attack of lung fever, at Prad, in Tyrol, Aug. 25, will be a shock to those who have been interested in his notable articles and works. Dr. Müller was an upper teacher in the real gymnasium of Lippstadt. He was a brother of the distinguished Fritz Müller, of Desterro, Southern Brazil. Herman Müller had, by his numerous articles, many of which were published in *Kosmos*, and his works, made himself the leading authority on the subject of the mutual relations of insects and flowers in promoting cross-fertilization. His two great works were "Die Befruchtung der Blumen durch Insekten," published in 1873, and "Alpenblumen, ihre Befruchtung durch Insekten," 1881. The previous work has just been translated into English by Mr. D'Arcy-Thompson, and is just published.

Dr. Müller was a gifted observer, and, like the brother who survives him, a scientist of marked individuality.

— The death is announced of Dr. Filippo Pacini, professor of anatomy at the University of Florence, and well known beyond the Alps for many valuable contributions to scientific medicine, especially in his studies on the nature of Asiatic cholera, and his system of artificial respiration.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Boston Society of Natural History, Oct. 3.—Mr. Fred. W. Putnam gave an account of the "Great Serpent Mound" in Adams county, Ohio, and of some other ancient works in Wisconsin and Ohio, examined during the past summer.

New York Academy of Sciences, Oct. 1.—A paper was read (by title and abstract) on The Patio and Cazo processes for the amalgamation of silver ores, used in Mexico and Chili, by Professor Thomas Egleston.

Sitzungsbericht der Gesellschaft naturforschender Freunde zu Berlin. 1882.—March 21.—Herr Nehring spoke of the so-called "wolf's teeth" of the horse, in relation to the genealogical development of the genus Equus. In front of the upper row of molars a small tooth is often to be seen, but is lost with the increase in size of the teeth. To be consistent, this tooth must be included in the dental formula, which will thus contain four premolars instead of three. A corresponding tooth is oc-

casionally, but very seldom developed in the lower jaw, but is well exhibited in the skull of a zebra examined. This additional premolar is a direct link with the tertiary Hippotherium and Anchitherium. The development of the horse is probably linked with that of the steppes, deserts and prairies; Herr Otto Hermes denied a statement of Von Siebold, to the effect that "up to the present time no male eels had been found in fresh water." Several male eels were found in the Lower Elbe, beyond the reach of sea-water; Herr Wittmack made some remarks upon the milky juice of *Ficus carica*; Professor Peters described the reptiles collected in Socotra by Dr. Riebeck. Among them are the new species *Diplodactylus riebeckii* and *Euprepes socotranus.*

April 18.—Herr Nehring stated that out of four zebra skulls he had examined, three showed the wolf's teeth, and that he had found them in place in the upper jaw of a horse forty years old, as well as in all four rami of a horse in its second year. This variation in size, joined to irregularity in its time of appearance, lends color to the idea that it was once a regular and full-developed tooth. In most cases these teeth appear between the cutting of the third milk-molars and that of the first molars. The reduction of the ulna and fibula, and their union with the radius and tibia, were then spoken of, and it was shown that among existing horses, not only a complete unbroken ulna sometimes occurred, but that even the fibula is occasionally as well-developed as it is in *Hipparion.* Herr Nehring also read a communication upon some fossil remains of a small species of horse from the Diluvium. He believed these and similar remains found elsewhere in middle Europe to belong to *E. hemianus.* Herr Rabl-Ruckhard treated of the development of the brain in the bony fishes. Herr Studer described *Arcturus foveatus*, and defined the new genus and species *Arcturides cornutus.* Herr Hilgendorf showed and described an apparatus for microscopic geometrical drawing.

Mey 16.—Herr Nehring described a skull of a house-dog with three tubercular teeth in each jaw, giving the formulæ p. m. 4.4 m 3.4, or 46 teeth in all, as in Otocyon. Also a skull of *Canis dingo*, with four premolars in front of the sectorial teeth in the upper jaw. Herr Nehring stated that he had examined skulls of the domestic dog which had five premolars in one or both sides of the maxillary, and an equal number in the under jaw also occurred. One dog-skull showed seven or eight upper incisors. Instances of a less number than the ordinary also occur. This reduction usually exhibits itself at either the front or hinder end of the series of molars, that is, it is either the second tubercular or the front premolar that is wanting. Herr Hilgendorf spoke upon the identity of the crustacean genera Brachynotus and Heterograpsus: the first of which has priority. Herr Dames remarked upon the fossil deer in the Pliocene strata of Attica. Herr Peters described three new species of Mormyrus, and one of Clarias, all African.

June 20.—Herr A. W. Eichler read a dissertation of L. Celakovsky upon the structure of the fruit scales of the Abietinæ, and added thereto extensive remarks upon their various forms in different genera, and upon their mode of development. Herr A. B. Frank made some remarks upon the hair cushions in the axils of the leaves of *Ercilia* (*Bridgesia*) *spicata* D. C., a Chilian plant, climbing over rocks or tree stems. Herr Peters described *Lagomys littoralis* from the Tschuktschi peninsula. Herr L. in Wittmack spoke upon the specific characters of the flowers of *Hordeum bulbosum* L.

July 13.—Herr Magnus described a new alga, *Cladophora ophiophila*, parasitic upon the surface of the freshwater snake *Herpeton tentaculatum*, a native of Siam, and also made some remarks upon the ovules of *Reseda lutea*. Herr von Martens described some new land and fresh-water Central Asiatic snails, of the genera *Helix* and *Buliminus*, and also a *Scalaria* and a *Turritella* found by the *Gazelle* expedition. Herr Peters described a new genus and species of Batrachia, *Hylonomus bogotensis* from Bogota. Herr H. Dewitz made a further communication upon the climbing apparatus of insects, as instanced by *Telephorus dispar*, *Stenobothrus sibiricus*, etc. Herr Eichler presented a communication from Th. Von Heldwich of Athens, upon heterophylly in *Ceratonia siliqua*, a Grecian plant much frequented by insects.

October 17.—Herr Nehring illustrated some points in the anatomy of *Halichœrus grypus* Fabr. Three species of this genus have been recognized by Hornbush, but are not usually accepted by zoologists, and Herr Nehring, in view of the considerable differences in the skulls of individuals, is inclined to place all in one species. The intestines were seventeen times the length of the body and were full of half-digested fish-vertebræ, and of *Ascaris osculata*. Herr Peters changed the name of his batrachian genus *Hylonomus* to *Hyloseirtus*, and presented two new species of snake, *Microsoma notatum* and *Liophis Y-grœcum* both from Brazil. Herr G. Schacko described the development of the embryo of the rhizopod *Peneroplis proteus* d'Orb. Herr Magnus spoke upon *Hypholoma fasciculare* and other fungi.

November 21. Herr Peters presented a new species of urodelous batrachian *Œdipus yucatanus*, from Yucatan. Herr Martens spoke of the land-shells of the Pacific coast of North America, and gave a list of the species.

December 19. Herr Peters described three new batrachia (*Amblystoma krausei*, *Nyctibatrachus sinensis* and *Bufo buchneri*), and made some remarks upon the pterygoid and palatine teeth of some Uropeltacea. Herr G. Schacko presented eleven examples of the bottom of the North sea. Herr Von Martens made some remarks on the fauna of the Black sea with a comparison between it and those of the Mediterranean and North sea.